INSTALLATION, OPERATION AND MAINTENANCE MANUAL FOR HM-2719·2713·1719·1713 COLOR MONITORS

HM-2719-C-11

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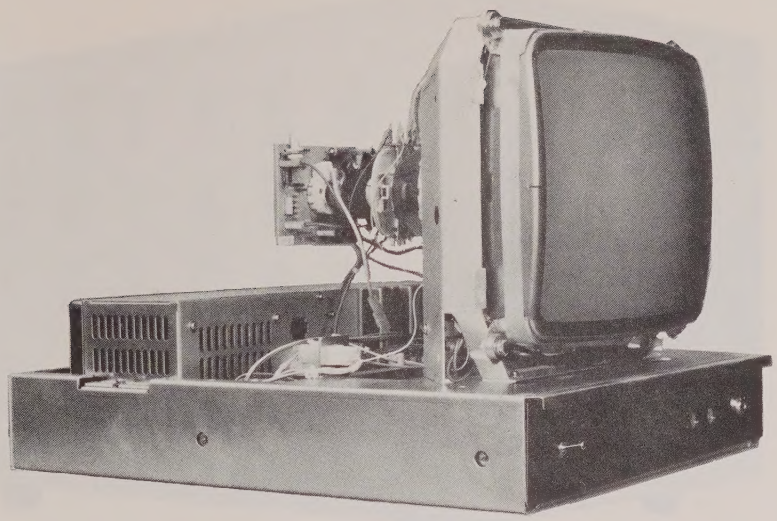
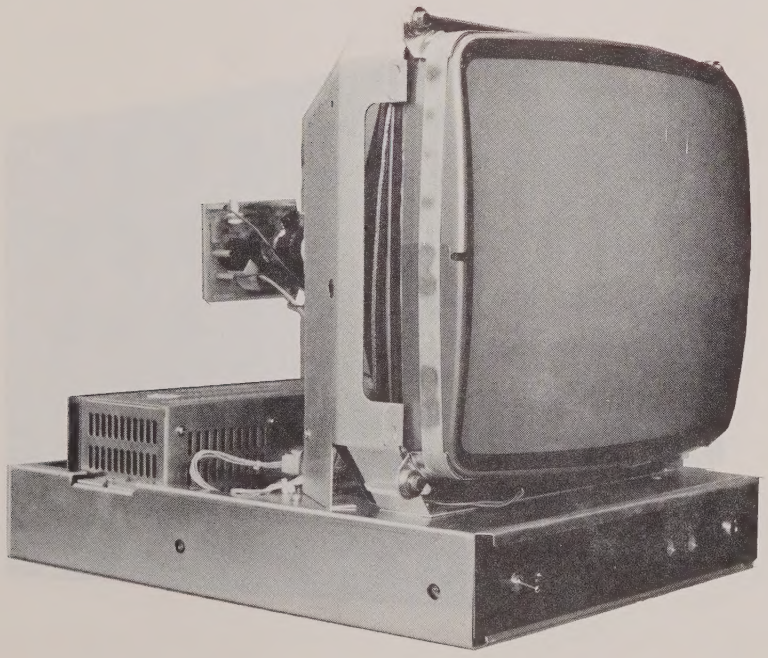


Models HM-2713/1713 color monitors (rackmount type)



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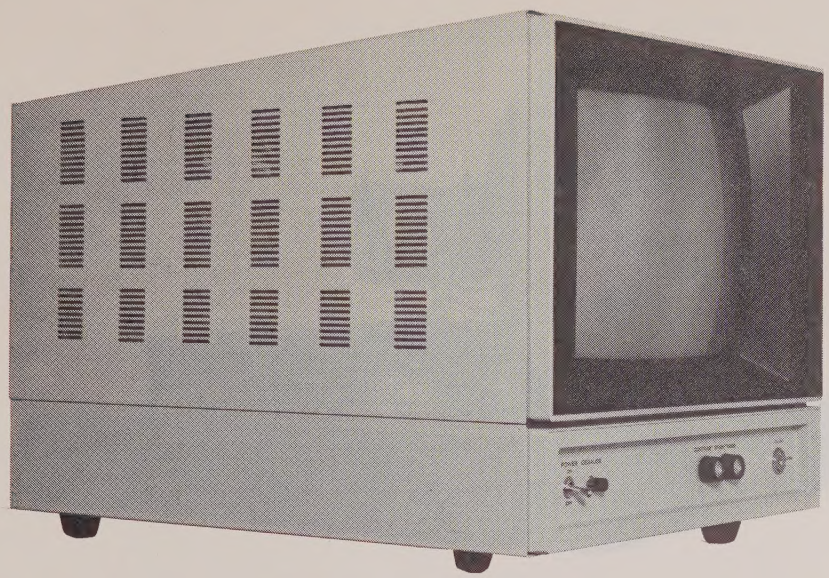
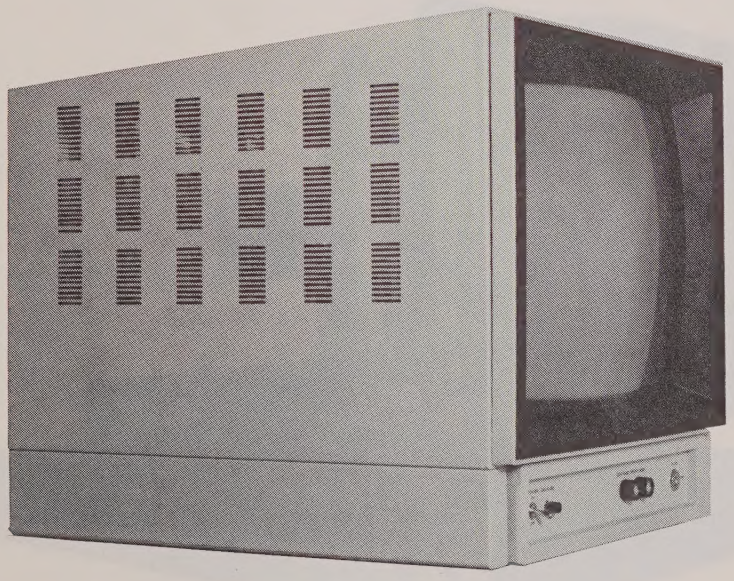


Models HM-2713/1713 color monitors (cabinet type)



Models HM-2719/1719 color monitors (cabinet type)

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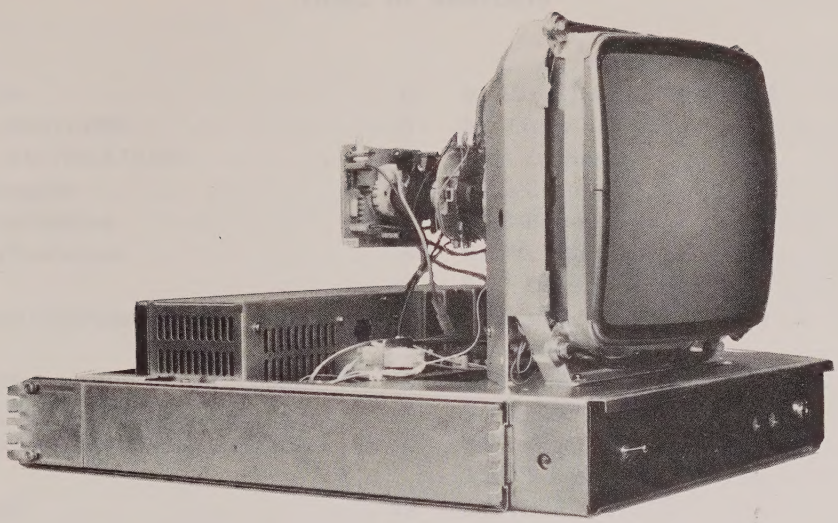
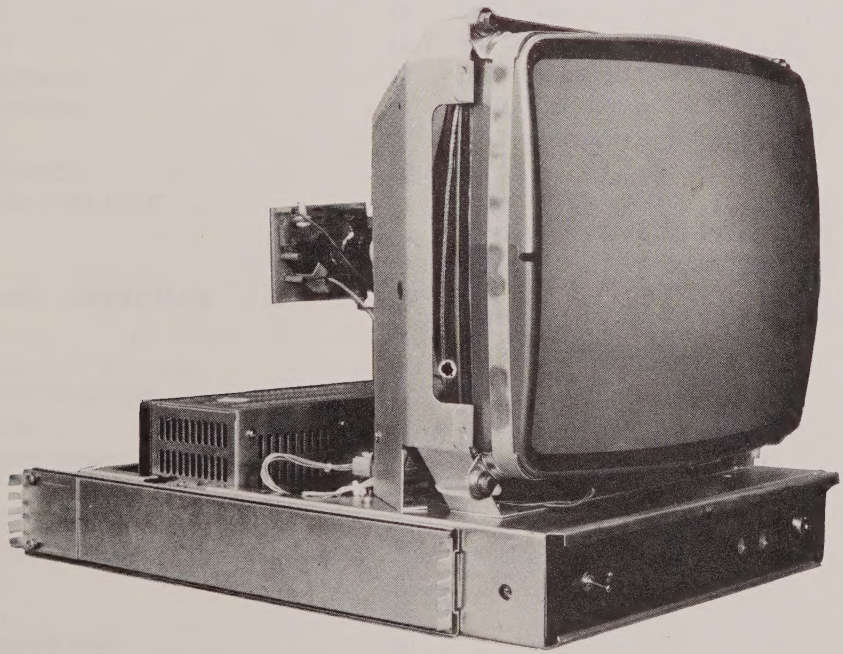
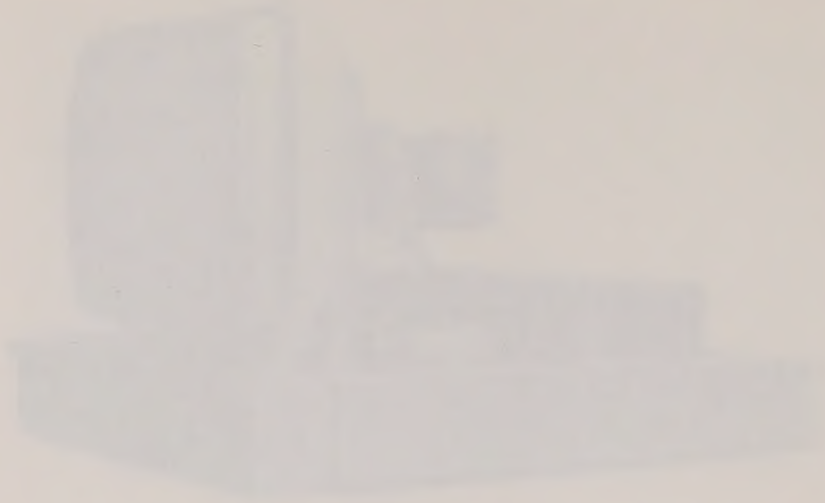


Models HM-2713/1713 color monitors (rackmount with slides)



Models HM-2719/1719 color monitors (rackmount with slides)



It is recommended that maintenance, operation and design personnel read the following chapters:

Maintenance : Chapters 1 through 6
Operation : Chapters 1 through 4
Design : Chapters 1 and 2

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V. SCHEMATICS AND FUNCTIONAL DIAGRAMS
VI. WAVE FORMS
VII. PARTS ARRANGEMENT

1. INTRODUCTION

1.1 TECHNICAL FEATURES

The HM-2719/2713/1719/1713 color monitor is designed to be an economical, high-performance RGB color monitor with in-line gun and provides the following features:

a. Self Convergence Adjustment
Self convergence in-line gun eliminates troublesome adjustments.

b. High Resolution
Clear and sharp pictures obtained from 0.012" (0.3mm) dot pitch and wide video bandwidth of 25 MHz.

c. High Reliability
Single PC board assures high reliability and easy maintenance.

d. Wide Range Adaptability
Wide range of sweep frequency (15—18KHz) and input voltages (100, 120, 200, 240 VAC) adjustable without soldering iron provide the easy adjustment of the monitor.

e. Stable Picture
Low power consumption in-line gun and high voltage stability provide the stable picture and long life operation.

1.2 TECHNICAL SPECIFICATIONS

1.2.1 Visual Perfomance

a. CPT:
In-line gun trio dot type

Type	HM-2719	HM-2713	HM-1719	HM-1713
Size	19"	13"	19"	13"
dot pitch	0.012" (0.31mm)	0.012" (0.31mm)	0.019" (0.47mm)	0.017" (0.43mm)

b. Resolution:
720 pixels: holizontal
540 pixels: vertical

c. Linearity:
No point on raster deviates from its proper position by more than 2% of raster hight.

d. Convergence:
Does not deviate more than 0.028" (0.7mm) from picture height in a centrally located area bounded by a circle whose diameter is equal to the picture height. Elsewheve, the deviation does not exceed 0.060" (1.5mm).

e. Raster size regulation:
Less than 1% change 0% to 100% APL (Average picture Level) at peak 6fL (Long persistence phospher), 15 fL (Normal phospher) luminance.

f. Black level stability:
DC restorer maintains black level shift to within less than 1% of peak luminance from 10% to 90% APL.

1.2.2 Electrical Specifications

a. Input signals:
Video Composite: 1Vp-p nominal (0.35V to 2.0V), Sync (composite on green input) negative polarity.
Non-composite: 0.7Vp-p nominal (0.25V to 1.4V) black negative
Ext. Sync 4Vp-p nominal (1.0V to 5.0V)
Impedance Switch selectable to either 75 ohms or higher impedance.

b. Impedance (optional):
Switch selectable to either 75 ohms or higher impedance.

c. Circuit performance:
Scanning frequency:
Frequency range:
Vetical 50 - 60Hz
Horizontal 15 - 18KHz
Standard Scanning frequency for 625 lines:
Vertical 50Hz ± 5Hz
Horizontal 15625Hz ± 300Hz
Standard scanning frequency for 525 lines:
Vertical 60Hz ± 5Hz
Horizontal 15750Hz ± 300Hz
Retrace time:
Vertical 1000 μsec. nominal
Horizontal 10 μ sec. nominal
Video aplifier bandwidth:
Flat within 3dB 50Hz to 25MHz at nominal input.
Fast pulse response:
Rise time: Approx. 30n sec. from 10% to 90%.
Fall time: Approx. 30n sec. from 10% to 90%.
Low voltage regulation:
Less than 1% change for variations from nominal line voltage of ± 10%.
High voltage regulation:
Less than 2% change over 0% to 100% APL at 6fL (Long persistence phospher), 15fL (Normal phospher) peak luminance.

1.2.3 Controls and Connectors

a. Front panel:
Contrast knob adjustment
Brightness knob adjustment
Power ON/OFF toggle switch
Degauss push button switch

b. Drawer:
Height potentiometer
Width potentiometer
Vertical hold potentiometer
Horizontal hold potentiometer
Red background potentiometer
Green background potentiometer
Blue background potentiometer

c. Rear panel:
Channel A: AMP connector (standard)
Test: BNC connector (optional)
Channel A: BNC connectors with loopthrough (optional)
Ext. Sync: BNC connectors with loopthrough (optional)

Impedance Select: toggle switch (optional)
Sync Select: toggle switch (standard)
Channel A/Test select: toggle switch (optional)
Fuse
AC power socket

1.2.4 Installation

a. Power requirements:
170W nominal
100V/120V ± 10% or 200V/240V ± 10% 50/60Hz ± 3Hz.

b. Power connector
AC power socket #17252.

c. Signal connectors:
AMP connector (standard)
Cup No. 1-480694-0
Plug No. 1-480691-0
BNC connectors (optional)

d. X-ray radiation:
.5mR/hour
(THE UNIT COMPLIES WITH U.S. DEPARTMENT OF HEALTH, EDUCATION AND WELFARE, X-RAY RADIATION SAFETY RULES, 21CFR, SUBCHAPTER.)

e. Heat dissipation:
395 BTU/hour nominal

f. Dimensions and weight:

		19 inch	13 inch
Cabinet	width	20.0" (504mm)	17.2" (436mm)
	hight	19.8" (502mm)	16.1" (408mm)
	depth	21.5" (546mm)	21.3" (542mm)
	weight	101 lbs. (46kg)	79 lbs. (36kg)
Rack-mount	width	19.3" (490mm)	16.9" (428mm)
	hight	18.3" (495mm)	14.8" (375mm)
	depth	21.7" (550mm)	21.1" (535mm)
	weight	77 lbs. (35kg)	57 lbs. (26kg)

g. Mechanical configuration:
Rackmount type without slides (standard)
Rackmount type with slides (optional)
Cabinet type (optional)

1.2.5 Environmental Conditions

a. Ambient temperature:
5 – 40°C with case cover (operating)
5 – 50°C without case cover (operating)

b. Humidity:
10 – 90% RH, no condensation

c. Vibration:
0.6G (± 0.02" (0.5mm) 1,000 rpm)

d. Shock:
10G

e. Altitude:
10,000ft.

1.2.6 Options

Model number indicates the following optionnals:
HM-2719/2713/1719/1713 [(a)] - [(b)][(c)]

a. Identifies the mechnical configulation
R: Rack-mount without slides (standard)
C: Cabinet (optional)
S: Rack-mount with slides (optional)

b. Identifies Picture Tube
0: Normal Phosphor (standard)
1: Long persistent phosphor (optional)

c. Identifies functional options
0: Amp Type (standard)
1: BNC connectors with loopthrough (optional)
2: (Future use)
3: BNC connectors with loopthrough and Channel A/Test select (optional)

1.2.7 Signal Waveform

CONFORM TO THE EIA RS-170 STANDARD WAVEFORM.

1.3 PHYSICAL DESCRIPTIONS

External dimentions of both rackmount type and cabinet type are illustrated in Figure 1-1, 1-2.

Figure 1-3 shows the relative measurements of slides equipped on the rackmount type chassis.

1.4 TEST EQUIPMENT AND SPECIAL TOOLS

The following test equipment and special tools, or equivalent substitutions are recommended to maintain the monitor:

a. Volt-ohm-Ammeter:
Simpson Model 260

b. High Voltage Probe 30kV:
Simpson catalog No. 00509

c. Oscilloscope:
Hewlett Packard Type 184A with two channel 50MHz amplifier Type 1801-A, Time base and delay generator Type 1821A, two 10-1 probes Type 10004D and a 50-to-1 probe Type 10002A.

d. Degaussing Coil:
G. C. Electronics catalog No. 9317

e. Hex Tuning Tool:
G. C. Electronics catalog No. 8284

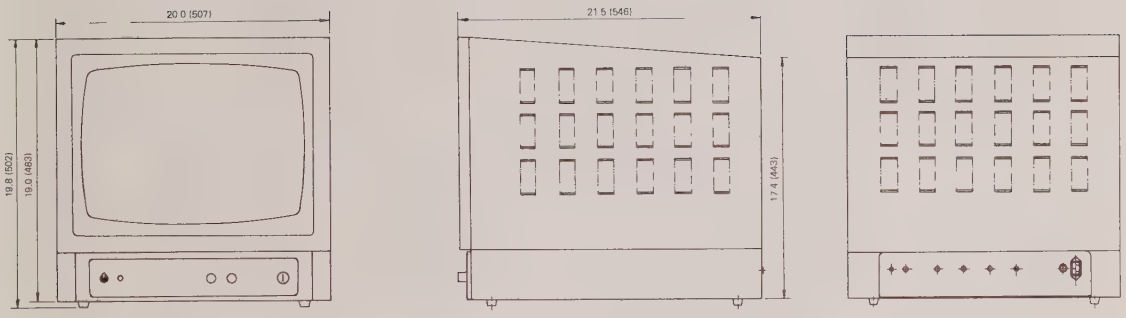
f. Alignment Screwdriver:
G. C. Electronics catalog No. 5009

g. Duplex Steel Blade Aligner:
G. C. Electronics catalog No. 8277

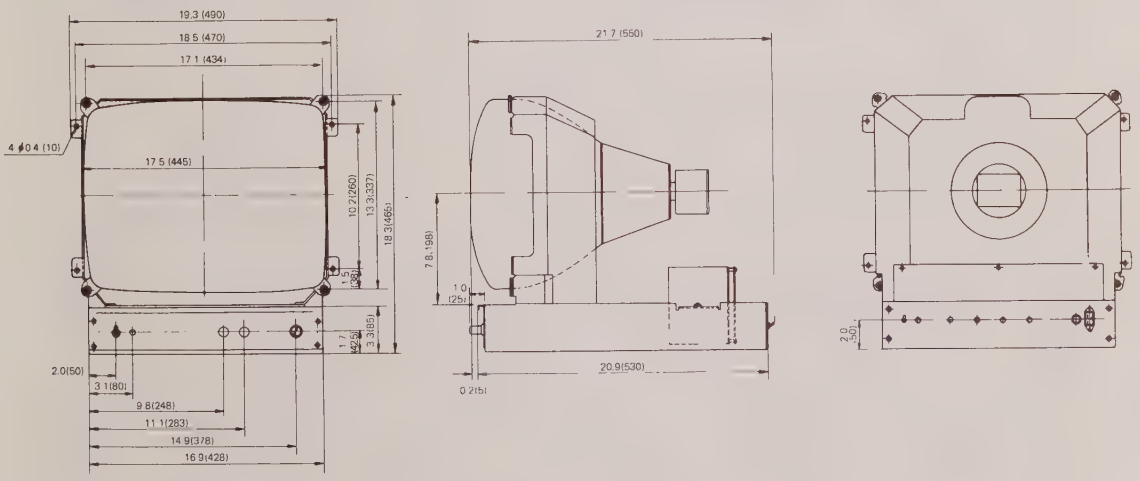
h. White balance adjuster
Shibasoku 898B

i. TV signal generator
Shibasoku { TG-7 (standard)
U703 (closs-hach Unite)

j. Magnifying glass (×10)

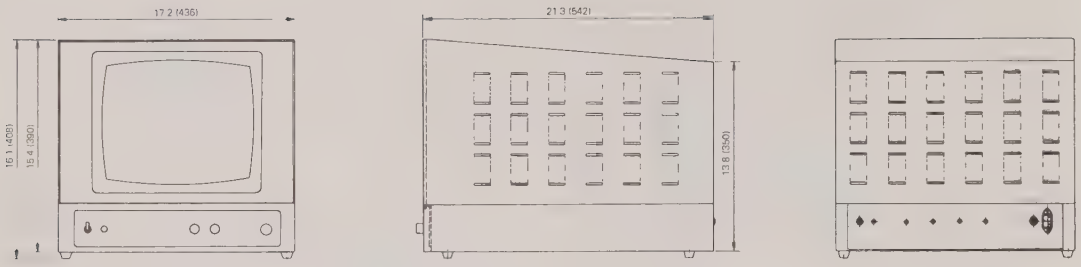


(a) 19" Cabinet Type

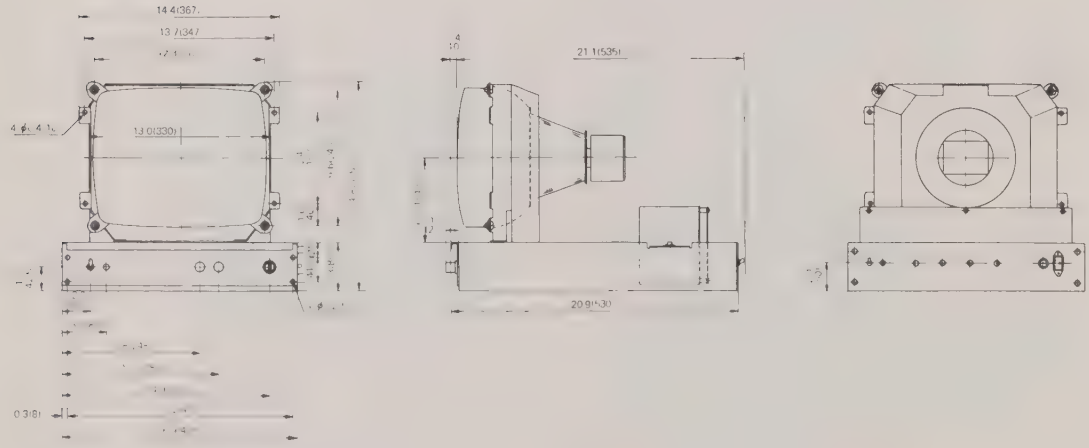


(b) 19" Rackmount Type

Figure 1-1 External Dimentions

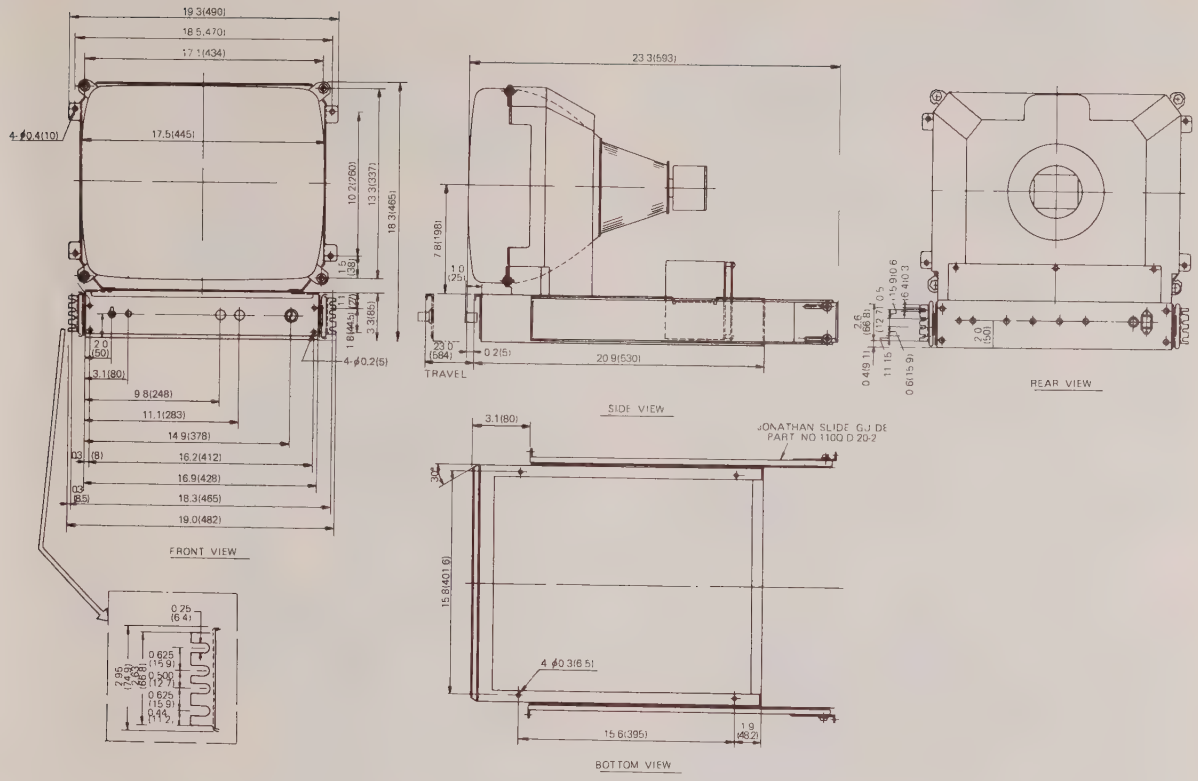


(a) 13" Cabinet Type

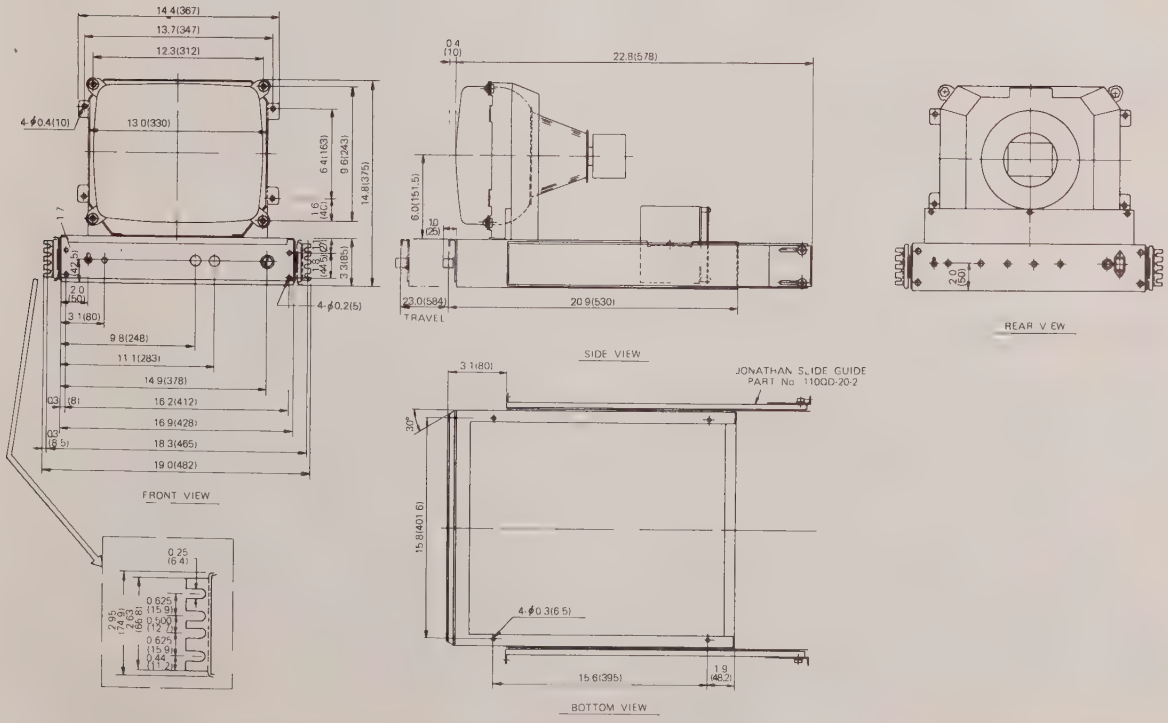


(b) 13" Rackmount Type

Figure 1-2 External Dimentions



(a) 19" Rackmount Type with Slides



(b) 13" Rackmount Type with Slides

Figure 1-3 Relative Measurements of Slides

2. INSTALLATION

2.1 UNPACKING

2.1.1 Package

The monitor is normally packaged in a carton box and its dimensions and weight are as follows:
Dimensions:
28.0" (710mm) wide,
31.5" (800mm) high and
31.5" (800mm) deep
Weight :

13" Cabinet	142 lbs. (65kg)
19" cabinet	164 lbs. (75kg)
13" Rackmount	120 lbs. (55kg)
19" Rackmount	140 lbs. (64kg)

Standard accessories of 2 keys, 1 fuse and 1 manual are also packed in a carton box.

2.1.2 Unpacking

a. Package weight of the carton box is more than 44 lbs. (20kg.) So, it is desirable to handle it by two men.

b. The monitor is normally packaged in a carton. Unpack the monitor carefully, make sure not to scratch or strike the picture tube face. The rack-mount types require additional attention because the neck of the color picture tube is exposed.
Packings are illustrated in Figure 2-1.

c. Please read the following section before connecting the color monitor to any AC power supply.

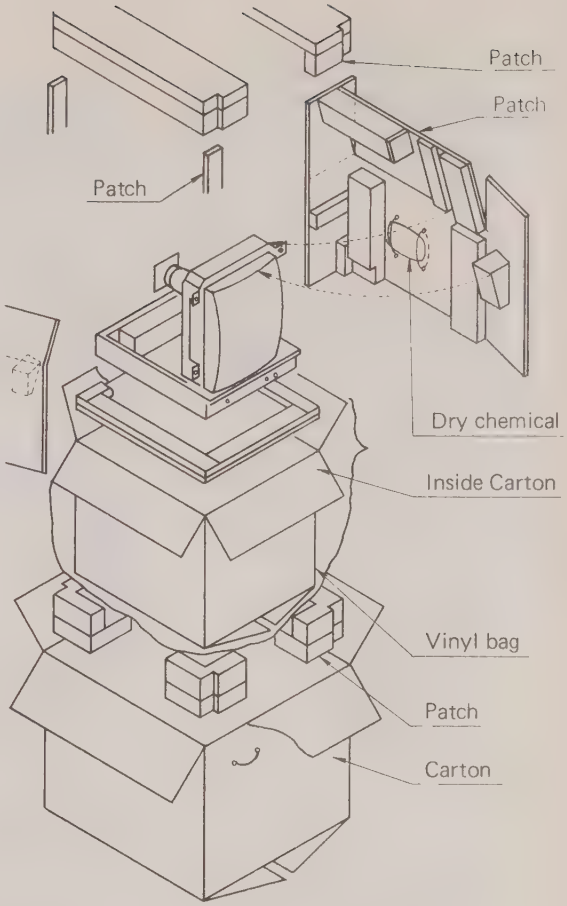


Figure 2-1 Packing Procedure

2.2 PRECAUTION

2.2.1 Installation Precaution

The convergence of color monitor is subject to the influence of external inductive fields. Avoid installing the unit in areas where inductive fields are present. The following additional items will ensure proper monitor operation:

a. Ventillation:

For long time stable operation, the temperature inside the case must be kept below 60°C.
Allow sufficient spacing between the monitor and its surroundings as illustrated in Figure 2-2.

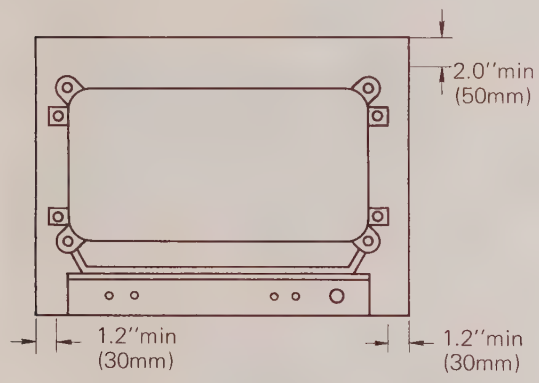


Figure 2-2 Installation Area

Specifically, when this monitor is mounted in a cabinet, it must have vertical ventilation, both above and below.
If there is insufficient space between the monitor and its surroundings, a cooling fan is recommended.

b. Leakage flux:

Do not install the monitor in areas where a transformer, fan or other leakage flux source will be nearby.
Because AC leakage flux causes oscillation of the picture, and DC flux (magnet or the like) causes raster distortion and makes the purity of the picture worse.
If it is necessary to mount such a device in the vicinity, the following minimum requirements must be met. For a transformer, attach to it a shield ring and shorting ring, and design its windings in a balanced type to minimize leakage flux. For devices other than transformers, minumize leakage flux by means of a magnetic shield or non-inductive windings.
The color monitor is susceptible to the influence of external magnetic fields.
To eliminate misconvergence avoid an inductive magnetic field as far as possible when installing the unit.
A magnetic field of more than 0.01 Oe will cause noticeable distortion.

c. High vibration:

Although this monitor is designed to withstand vibration, it is still advisable to mount it on a vibration preventive base for long-time stable operation especially when it is installed on a vehicle or the like.
The same caution should be exercised when there is a source of vibration in the vicinity.

d. Humidity:

This monitor can be operated within a relative humidity range of between 10 and 90%.
If it is operated in a humid environment for a long time, however, its life time may be shortened by deterioration of connector contacts or rheostats.
It is, therefore, advisable to operate the unit in a humidity range of between 30 and 70%.

e. Ambient illumination:

This monitor employs a black matrix color picture tube which provides excellent resistance to glare or reflection in high ambient light.
It is, however, still advisable to avoid direct light sources shining onto the CPT screen in order to prevent eye fatigue.
In direct sunlight or high ambient lighting, use of a visor is recommended. (Figure 2-3)

f. Dust:

This monitor is designed to minimize dust collection. PCBs carrying major components are arranged vertically. However, because of the high static electric fields, dust will be attracted through the cabinet ventilation holes. Therefore, precaution should be taken to minimize dust in the vicinity.
It is advisable to periodically clean the anode cap of the CPT which tends to collect dust electrostatically.

g. Power voltage:

On this monitor which incorporates a voltage regulator circuit, the picture is not influenced by a voltage fluctuation within ± 10% of the rated value.
Operation over +10% should be avoided, however, because of excessive heating in the interior and incidental detriment to the life time of the unit.
Either 50Hz or 60Hz can be used without any modification of the unit.

h. CPT screen dirt

The explosion-proof CPT used in this unit has no front protective glass.
Therefore, dirt on the CPT screen can easily be wiped off.
As hypertension is applied, the CPT screen tends to collect dirt, which degrades brightness and focus.
Use of soft cloth dampened with a silicone type glass cleaner is recommended for periodic removal of this dirt.
Do not use a thinner or the like instead of a cleaner. (The escutcheon may be stained.)
The static change on the CPT screen may result in a shock if the screen is touched in a low-humidity environment. To avoid this, prepare a wet towel (wrung tightly), touch one end of it to the case and the other end to the CPT screen, and press lightly to cause discharge.

i. Installing a visor

1. Place the CRT with its front up and remove four rubber legs as shown in (a) below.
2. Install a visor support plate at the front end and spacers on the underside, as shown in (b).
3. Set the CRT up, install the visor over the top, and fasten it with four bolts, as shown in (c).

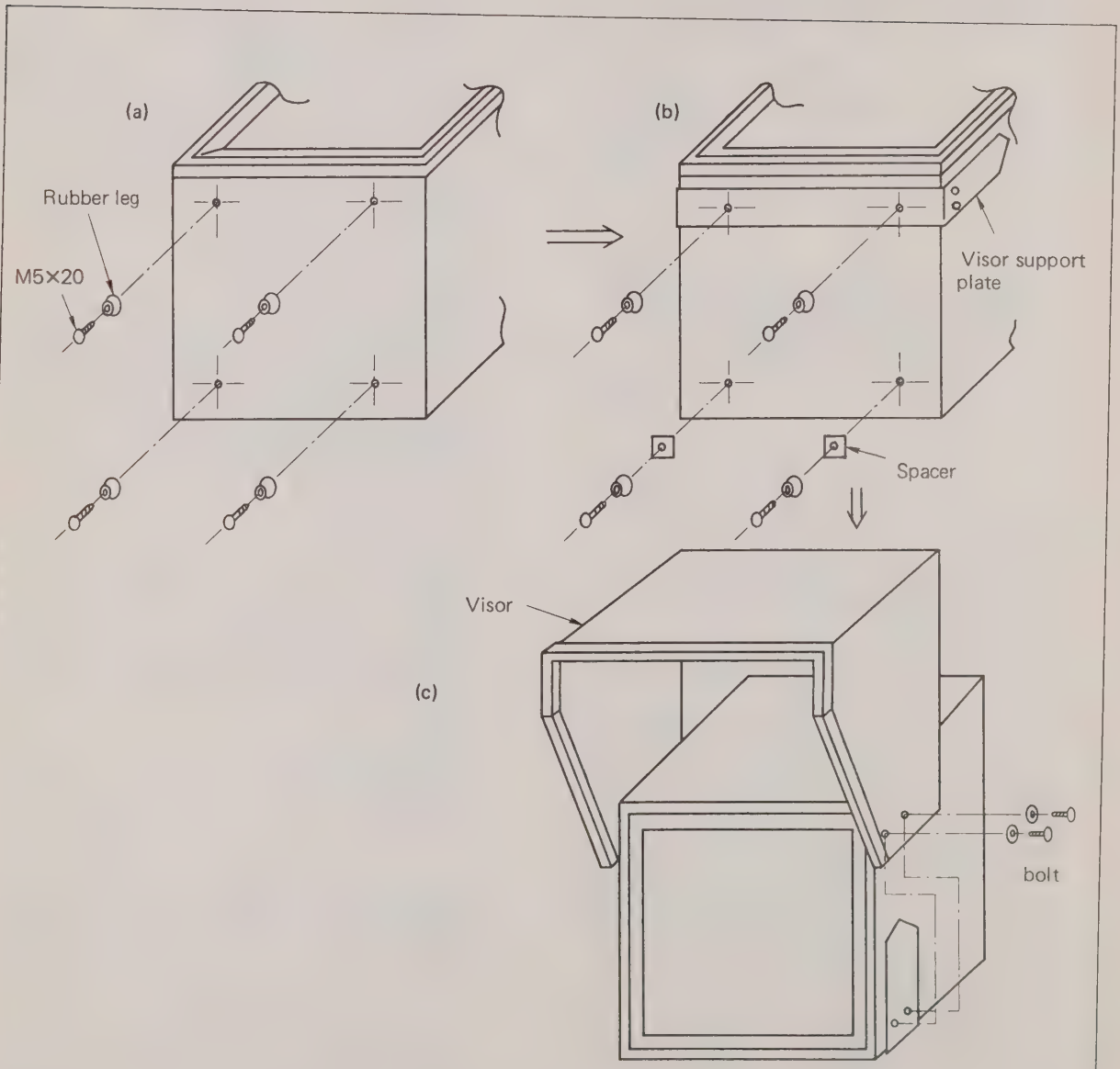


Figure 2-3 Installing a Visor

2.2.2 Safety Precaution

a. Dangerous voltage exists within the display unit and the pedestal.
Normal electrical precaution should be observed whenever working within those units while the covers are removed.

b. Disconnect the monitor from the power source, before removing or replacing circuit cards and components.

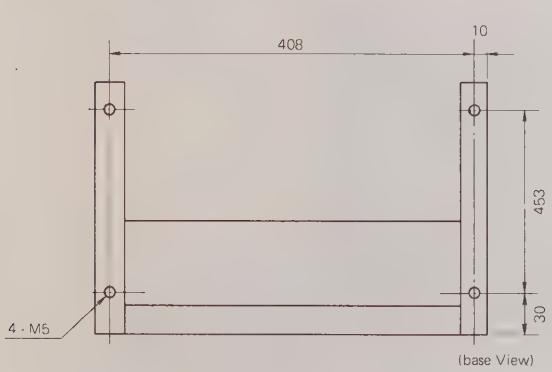
c. Caution must be exercised during the replacement or servicing of the CPT since a residual electrical charge may be contained on the anode button.
Be sure to ground the soldering iron and measuring instruments.

2.3 MOUNTING INSTRUCTIONS

2.3.1 Rackmount Type

a. Rackmount type without slides

The rackmount type monitor without slides is standard.
The monitor can be fixed with four screws on the flat pedestal.
Measurement of the base view is shown below.
If the use of slides is desired, user may prepare the slides.



b. Rackmount type with slides

Slides, model 110 QD-20-2, Jonason Manufacturing Co., are used and relative measurements are shown in Figure 1-3.

2.3.2 Cabinet type

The cabinet type monitor is placed on a stable supporting surface within the user's system configuration. To remove the cabinet, loosen four screws on the bottom of the cabinet, push the back panel, and pull the chassis to backward. (Figure 2-4)

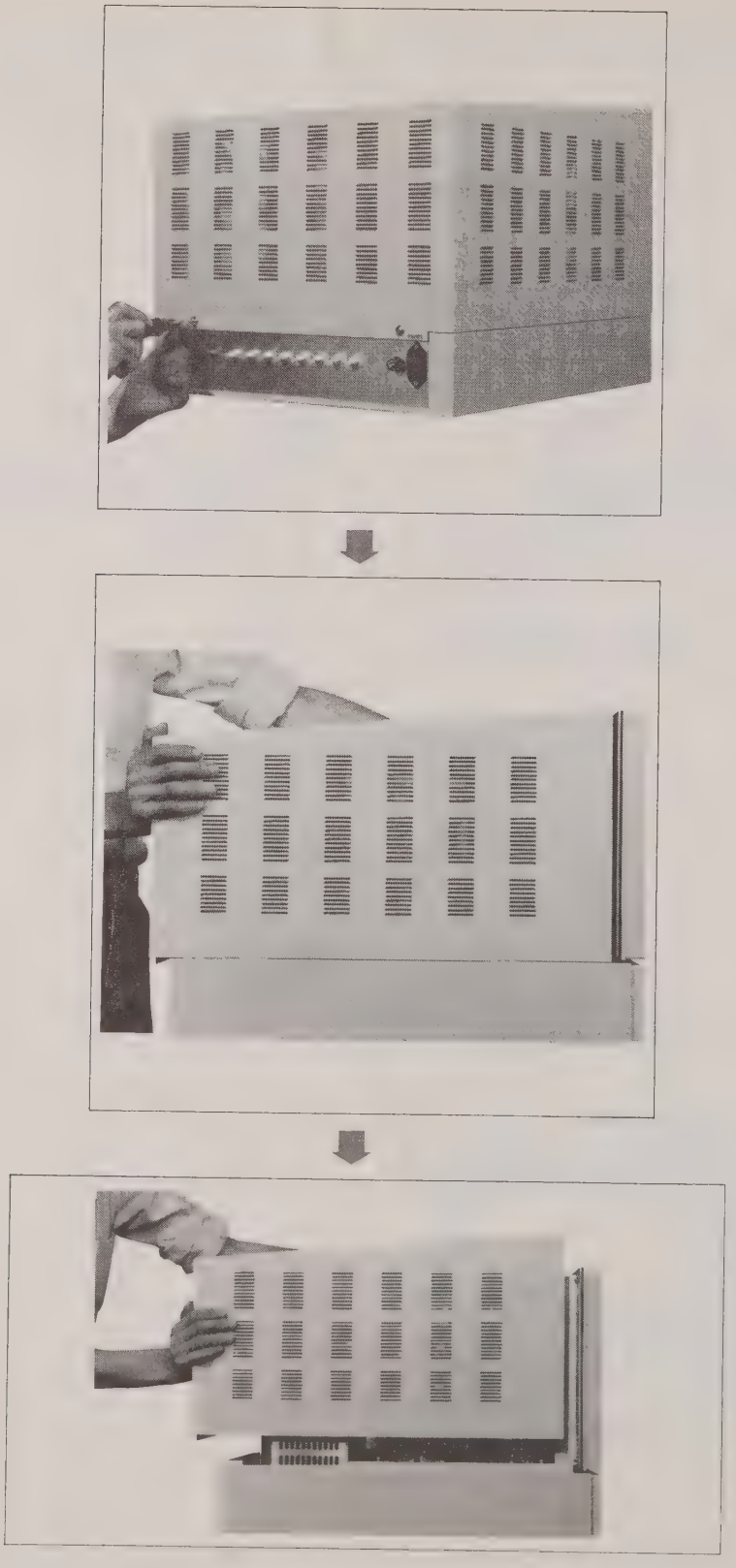


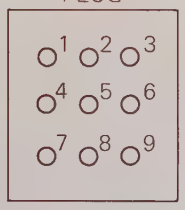
Figure 2-4 Removement of cabinet

2.4 VIDEO INPUT

2.4.1 AMP Type Connector

The standard connector for video input of this monitor,AMP connector model 1-480691-0, is located on the rear panel.
Figure 2-5 shows the mechanical configuration of the rear panel and PIN assignment of AMP connector.
The green video signal input containing the composite sync, no external sync input is required and sync selector switch much be set to "COMPOSITE".
When using external sync input, the sync selector switch must be set "EXTERNAL" and sync input on the PIN numer 7 and 8 of the connector.

PLUG



PIN NO	SIGNAL
1	RED
2	GD
3	GREEN
4	GD
5	BLUE
6	GD
7	EXTSYNC
8	GD
9	—

CUP NO. 1-480694-0

PLUG NO. 1-480691-0

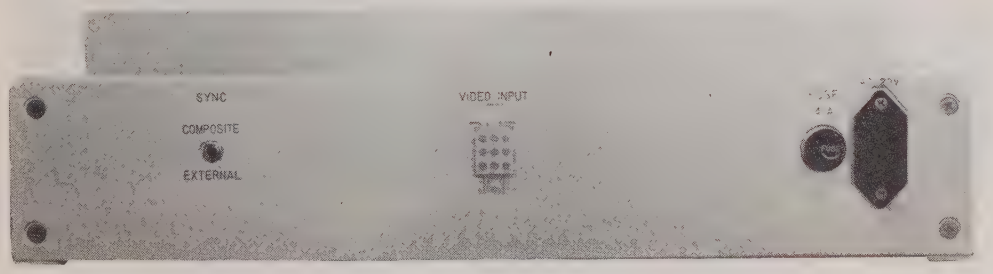


Figure 2-5 Rear Panel Configuration (AMP connector)

2.4.2 BNC Type Connectors

BNC connectors with loopthrough and external sync are optional.

Connected red, green and blue video to the appropriate video input connecters on the rear connector panel as shown on Figure 2-6.

The video cables must be constructed with 75-ohm coaxial cable, and terminated at the monitor cable end with standard BNC connector plugs.

If the green video signal input to the monitor contains composite sync, no external sync input is required.

When using external sync, the sync selector switch must be set to "EXTERNAL". Otherwise, it must be set to "COMPOSITE".

If the monitor is used in a loopthrough position, the input impedance selector switch must be set to "HIGH".

For single unit operation, or when the monitor is the last unit in a loopthrough series, the input impedance selector switch must be set to "75 Ω ".

Channel selector switch must be set to "CH. A".

(a) BNC Connectors with Loopthrough

(b) BNC Connectors with Loopthrough, and Channel Select

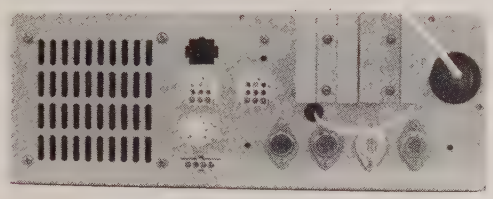
Figure 2-6 Rear Panel Configuration

2.4.3 Test Channel

Channel A/Test select function is optional and useful when testing the performance of the monitor.
BNC connector for test channel and channel selector switch are provided on the rear panel of the monitor as shown in Figure 2-6 (b).
Connecting green video to the connector "TEST" and setting channel selector switch to "TEST", monochrome picture is displayed on the screen.
If the green video signal input contains composite sync, no external sync input is required.
When using external sync, sync input must be connected to external sync connector and sync selector switch is set to "EXTERNAL".

2.5 AC POWER SOURCE

The monitor can use power line frequencies from 50 to 60Hz without modification and can be connected to supply voltages from 100V to 240V by selecting the correct transformer and corresponding connections.
Unless special arrangements have been made, the monitor set for 120V.
Figure 2-7 shows the transformer connections and switches necessary to accomodate different AC voltages, 100V/ 120V and 200V/240V, by means of connector CN 802.
For proper protection, be sure that the fuse is the correct type and rating for the line voltage used.
The ratings of the fuses are 100V/120V 4A and 200V/240V 2A.
After making the necessary transformer switch selections, plug the AC line cord into the power socket on the rear panel and connect the cord to the AC power source.



CONNECTOR (CN802)

CONNECTIONS

NOMINAL	RANGE	JMP – 1	JMP – 2
100Vac	90 – 110V	1 – 5	2 – 6
120Vac	108 – 132V	1 – 4	3 – 6
200Vac	180 – 220V	2 – 5	
240Vac	216 – 264V	3 – 4	

Figure 2-7 Transformer Connections

2.6 INSTALLATION CHECKOUT

Apply a test pattern or some other suitable video to the video inputs.

Connect the monitor to an AC power source and turn the POWER switch on the front panel to the ON position.

There is normally a thirty (30) Second delay from the application of power to the appearance of an image. Adjust the front panel controls (brightness and contrast) for the desired viewing level.

If the color purity or the convergence appear to be slightly out of adjustment, depress the DEGAUSS control, hold it for several seconds and then release it. The image should improve noticeably.

If the monitor does not display an image, or if the displayed image is distorted and cannot be corrected, refer to the maintenance procedures given in Section 6.

3. OPERATION

3.1 CONTROLS AND CONNECTORS

This section describes controls and connectors on the front and rear panels.

3.1.1 Front Panel (Figure 3-1)

a. POWER switch

This switch is a toggle switch which applies operating power to the electronic circuits.

b. DEGAUSS switch

Pushing this switch for more than 3 seconds operates the internal degaussing system.

c. CONTRAST Knob

Adjust the luminance level.

d. BRIGHTNESS Knob

Adjust the black level of the screen.

3.1.2 Rear Panel (Figure 3-2)

a. SYNC switch

Composite sync or external sync selector switch. When using the composite sync (on green video signal), the switch must be set to the composite position.

b. INPUT IMPEDANCE switch (optional)

75ohm termination or loopthrough selector switch.
If only one monitor is connected to the display generator, set this switch to the 75Ω.
On the other hand, when connecting a next-stage monitor, turn the switch to HIGH.

c. RED, GREEN, BLUE connectors

AMP connector is standard and its PIN assignment is shown in Figure 2-6.
This connector is connected to the display generator.
BNC connectors with loopthrough function is optional.
These terminals are connected to the display generator or a next stage monitor.
(connect R, G and B to their respective positions)

d. AC power cord socket

Two-prong socket is equipped on the rear panel.

e. FUSE

100V/120V 4A or 200V/240V 2A fuse will be mounted on the fuse holder, corresponding to the AC power voltage.

f. EXT SYNC connectors

Connectors for external sync signal input or loopthrough.

g. TEST connector (optional)

Connector for monochrome display signal input.

h. CHANNEL selector switch (optional)

CH. A (Red, Green, Blue) input or TEST (monochrome) input selector switch.

3.2 OPERATING INSTRUCTION

3.2.1 Initial Operation

The following equipment is commonly used in the industry to conduct these test:
Degaussing Coil, hand held if necessary, and Crosshatch Generator.
Procedures before adjustment are:

a. Connect the AC line cord to the AC INPUT on the rear panel of the monitor.

b. Connect the R.G.B singnal output cord of the crosshatch generator to the R.G.B signal input connectors.
When using external sync, connect the external sync line cord to the EXT. SYNC INPUT of the monitor.

c. Set the rear panel sync switch to the respective position.
SYNC SWITCH

Composite video signal	COMPOSITE
External sync signal	EXTERNAL

d. Turn the INPUT IMPEDAVCE switch to 75Ω, when connecting only one monitor to the crosshatch generator, and when connecting several monitors, turn the switch to HIGH and the last monitor switch to 75Ω.

e. Turn on and operate the monitor for a half hour. During this time, degauss the monitor.

- Push the DEGAUSS switch on the front panel for more than 3 seconds.
  Repeat every two minuts, if necessary.
- Turn on the hand-held degaussing coil at a distance of 1 meter from the monitor. Move it to within about 10cm of the top and side of the monitor. Make a slow circular movement a few times.
  Then move the coil gradually away from the monitor and turn off the coil.

f. Apply a crosshatch signal.

3.2.2 Preliminary Adjustment (Figure 3-3)

a. Sync adjustment

If horizontal synchronism is lost, adjust H-HOLD on the control drawer. And if vertical synchronism is lost, adjust V-HOLD on the control drawer.
Refer to Section 5.2.1 "Horizontal Hold" and "Vertical Hold".

b. Size adjustment

Vertical and horizontal amplitudes are adjusted by "HEIGHT" and "WIDTH" potentiometers on the control drawer, refer to Section 5.2.1 "Hight" and "Width".

c. Purity check

Turn on only the RED BEAM switch and turn BRIGHTNESS on front panel to produce red raster of the appropriate brightness. If the red raster is not uniform over all the picture, refer to Section 5.4 PURITY ADJUSTMENT.

d. Convergence check

Turn on the other BEAM switches to generate a white crosshatch pattern. If there is any convergence error, refer to Section 5.4 CONVERGENCE ADJUSTMENT.

Figure 3-1 Front Panel

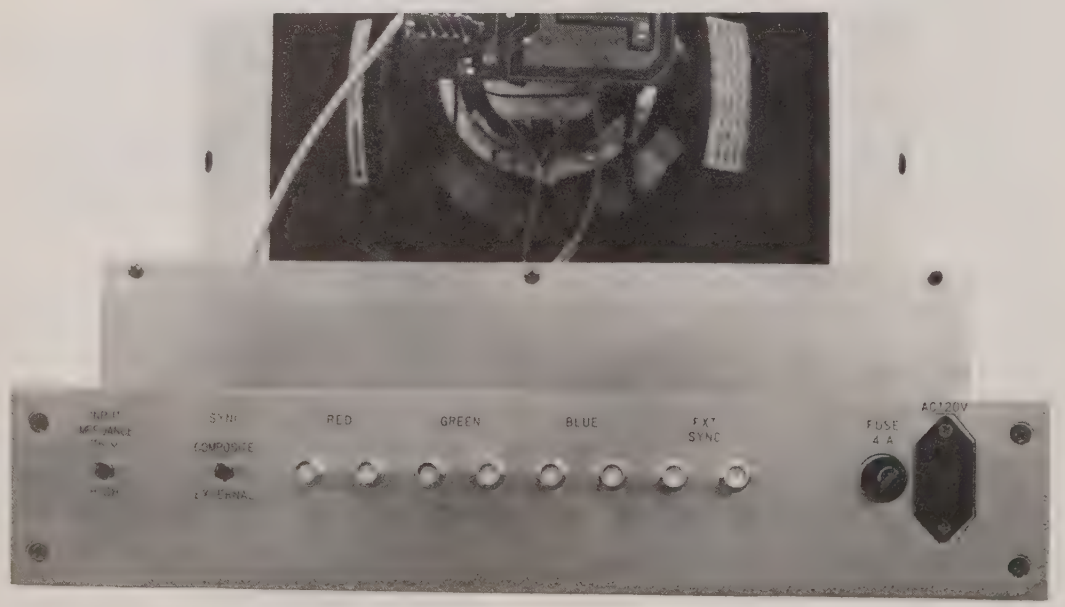


Figure 3-2 Rear Panel

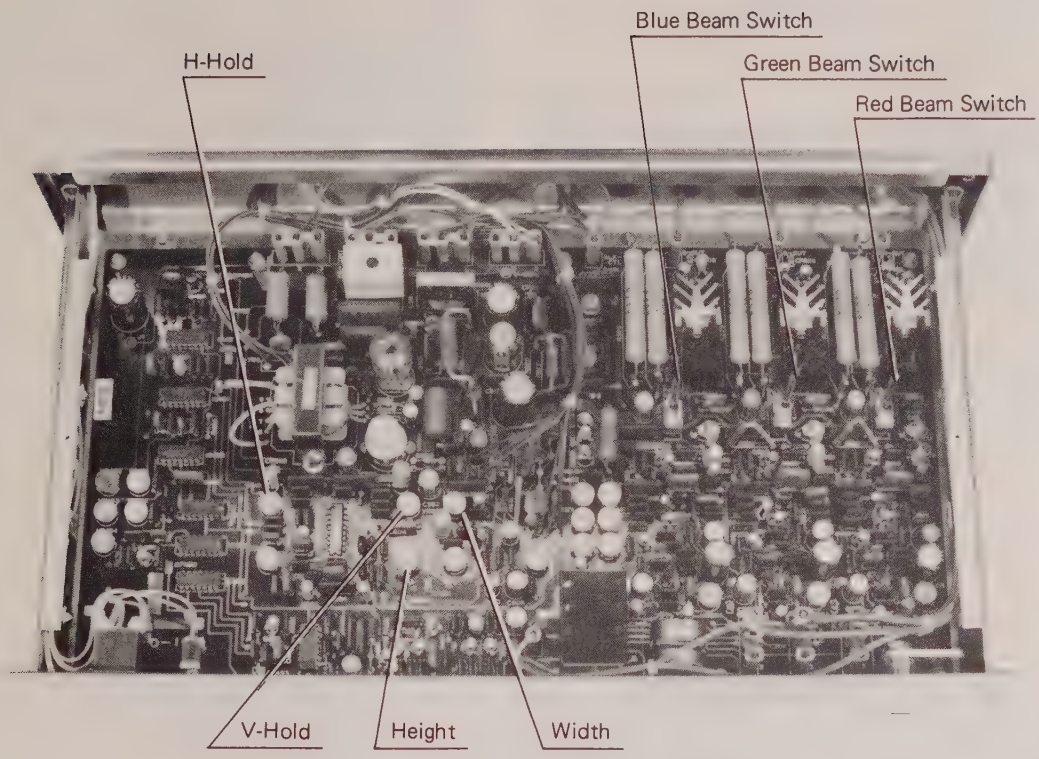


Figure 3-3 Control Drawer

4. THEORY OF OPERATION

4.1 GENERAL DESCRIPTION

4.1.1 Input Signals

Input signals include video signals, vertical shynchronizing signals, vertical blanking signals, horizontal synchronizing signals and horizontal blanking signals applied sequentially.
The horizontal synchronizing signals and the vertical synchronizing signals are input during their respective blanking interval. Figure 4-1 shows the horizontal blanking interval.

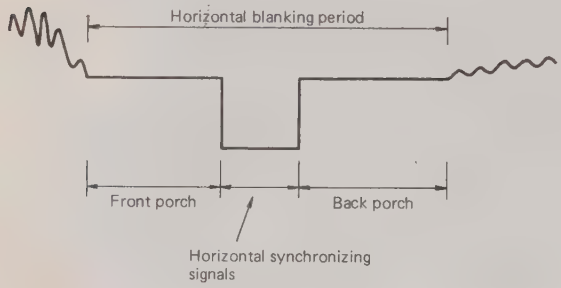


Figure 4-1 Horizontal blanking period

The vertical blanking interval includes the equalizing pulse, the vertical synchronizing pulse and the horizontal synchronizing pulse as specified in EIA Standards.
Figure 4-2 shows an expanded view of the vertical blanking interval.

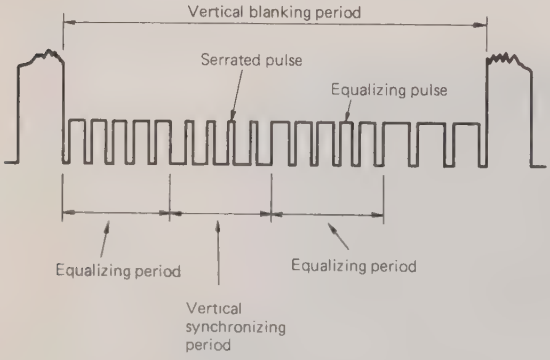


Figure 4-2 Vertical blanking period

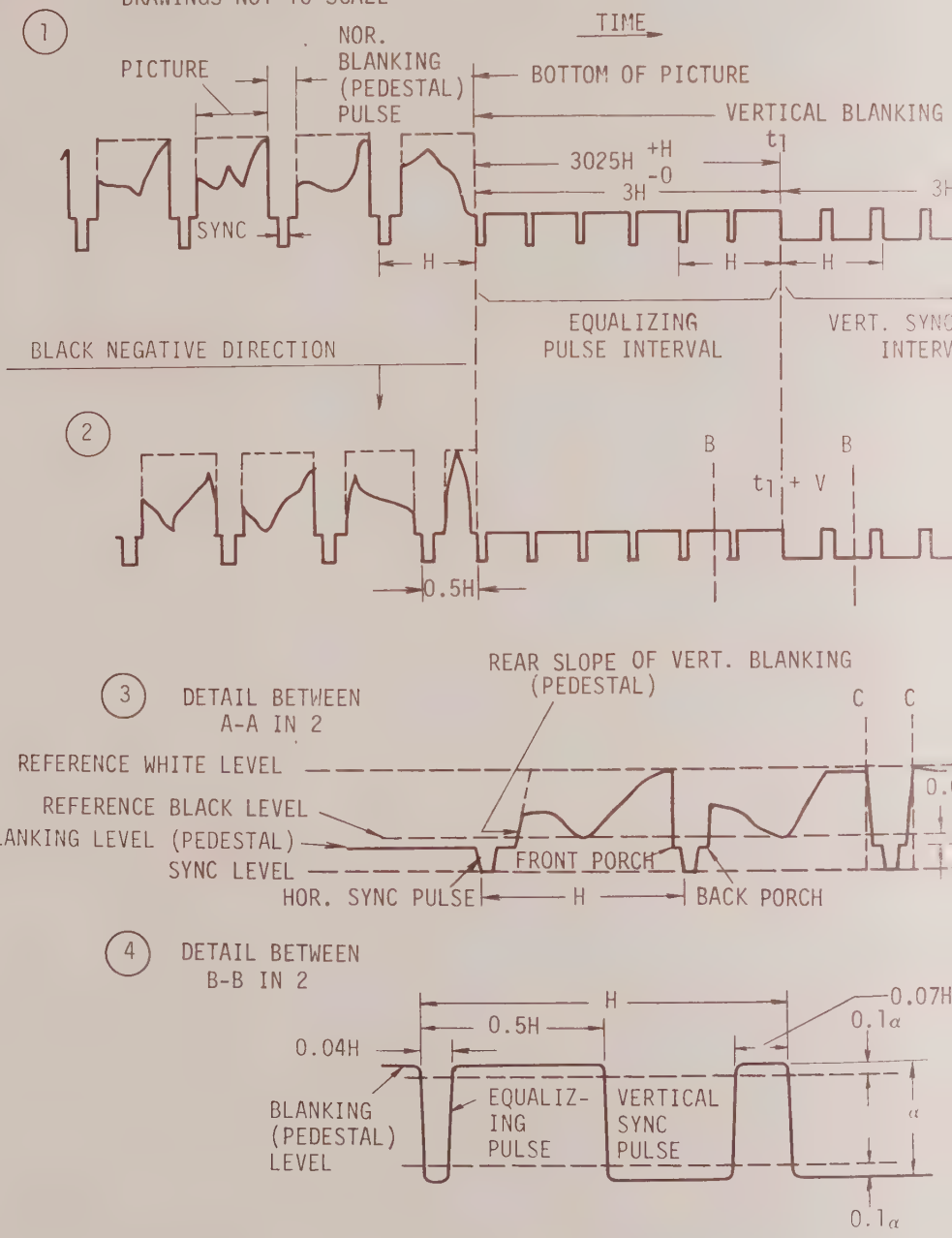
Figure 4-3 and Figure 4-4 show the waveforms of EIA Standards.
Equalizing pulses stabilize the horizontal synchronization of the monitor during the horizontal blanking interval.
These pulse frequencies are double the horizontal synchronizing frequency to provide perfect interlaced scanning.

SYNC SIGNAL AMPLITUDE α SHALL BE HELD CONSTANT WITHIN ±4% DURING TRANSMISSION

$\beta = 1.0 \pm 0.05$ VOLTS

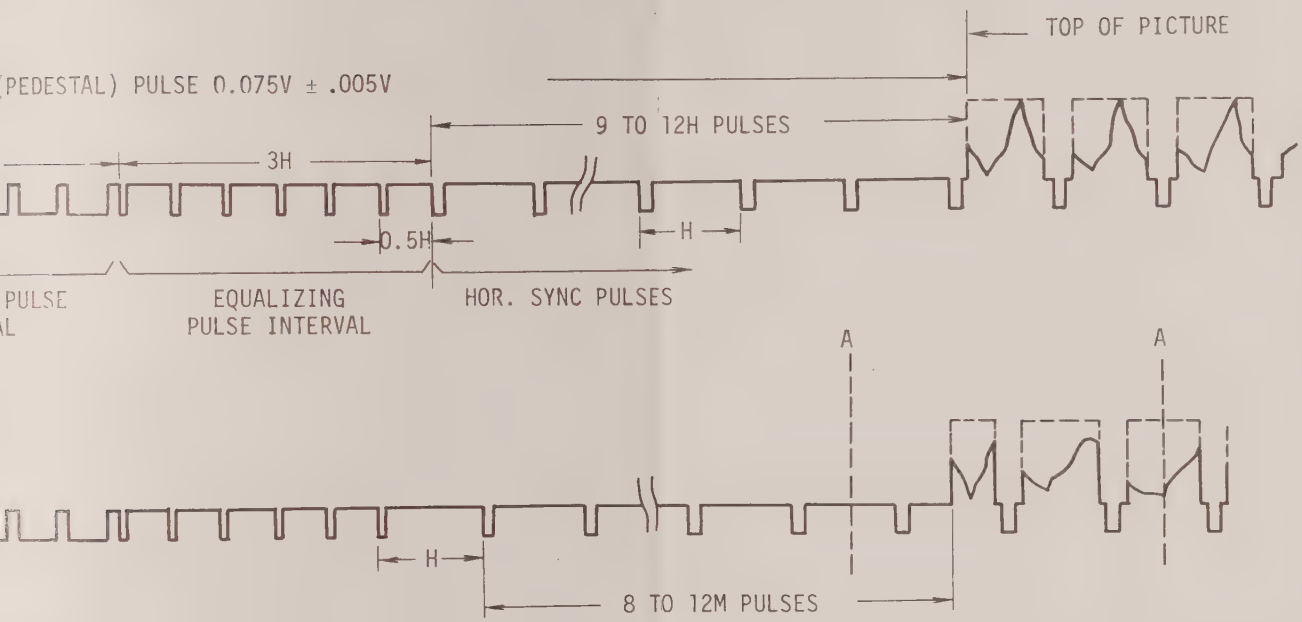
$\alpha = 0.4\beta \pm 0.05\beta$

DRAWINGS NOT TO SCALE

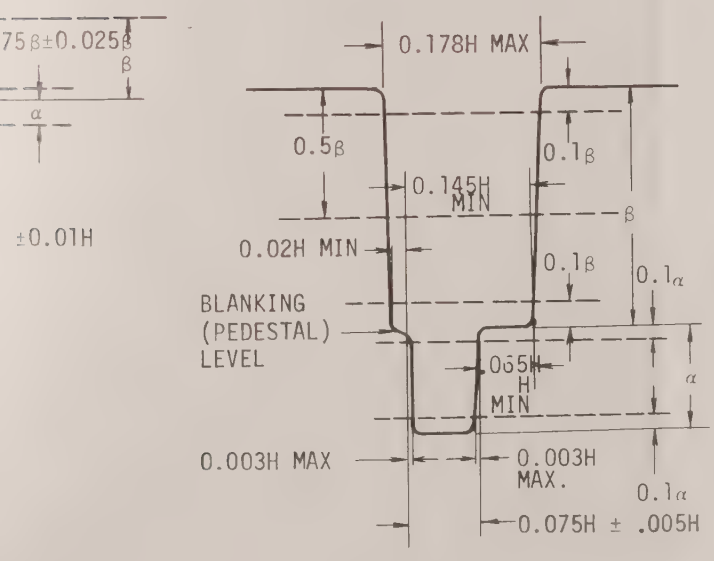


RISE TIME & DECAY TIME OF ALL PULSES 0.003H MAX.

Figure 4-3



(5) DETAIL BETWEEN C-C IN 3



INPUT SIGNAL WAVEFORMS

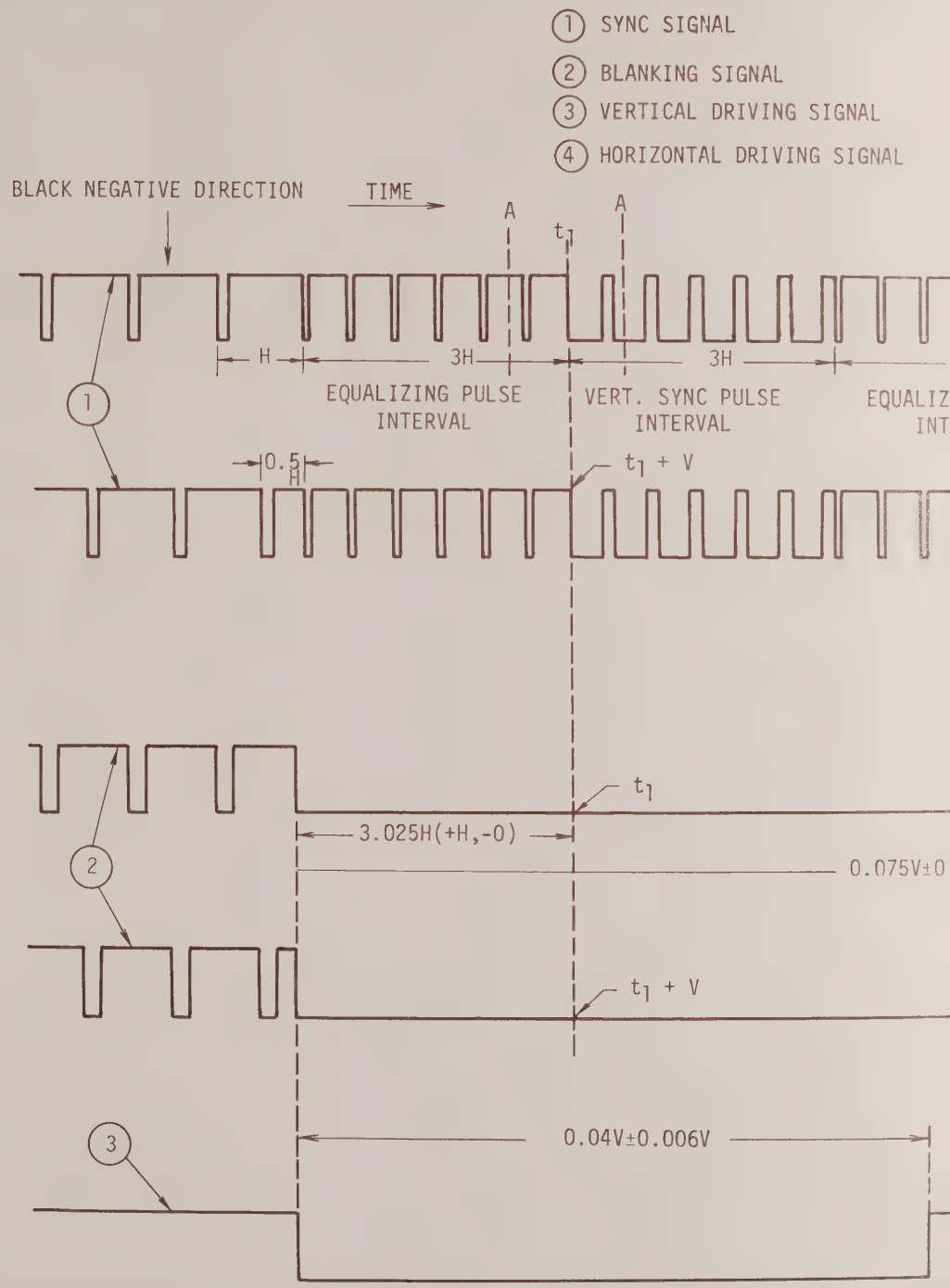

① SYNC SIGNAL
② BLANKING SIGNAL
③ VERTICAL DRIVING SIGNAL
④ HORIZONTAL DRIVING SIGNAL
BLACK NEGATIVE DIRECTION
TIME
A
A
t_1
H
3H
3H
EQUALIZING PULSE INTERVAL
VERT. SYNC PULSE INTERVAL
EQUALIZ
INT
1
0.5H
t_1 + V
t_1
3.025H(+H,-0)
0.075V±0
2
t_1 + V
3
0.04V±0.006V

Figure 4-4 S

4.1.2 Construction

a. Power supply unit

The power supply unit of this monitor is a circuit that supplies the appropriate voltages required by picture tube, video amplifier, deflection circuit, synchronizing circuit, etc.

b. Scanning section

Scanning is performed by shooting a beam of electrons to the fluorescent surface of the CPT and deflecting the electrons by changing the current applied to the deflection yoke.

Present TV sets generally scan by deflecting the beam of electrons diagonally accross the surface with saw-tooth wave current and by adjusting the beam on the surface, i.e. the scanning spot to control the focus.

Pictures are composed of lines of scanning spots. The number of lines is refered to as the number of scanning lines.

There are two types of scanning methods, one method scans sequentially and the other employs an interlaced scanning pattern to cover the entire picture.

In interlaced scanning, one vertical scanning is called field scanning and complete scanning by two field scanning is called frame scanning. Flickering on the screen can be reduced by shortening the scanning time for one field, thus this reduction can be achieved with interlaced scanning rather than sequential scanning when the scanning time for one frame is equal.

c. Video amplifier section

This circuit serves to amplify video signals to the input required by the picture tube.

It also has functions to distribute signals to the synchronizing circuit, DC restore circuit and high-pass characteristics compensation circuit and to adjust brightness.

d. Picture tube

This electron tube is designed to make light spots by applying electron rays from the electron gun to the fluorescent screen and to produce pictures by tracing the movement of these light spots as the electron rays are deflected by the delfection coil.

The fundamental construction of the picture tube is the electron gun and the fluorescent screen sealed in filter-shaped glass tube.

A typical electron gun is composed of a metal coil heater, a cathode, and five grids all mounted in line on the same shaft.

At present most widely used color picture tube is the shadow mask type. This type of picture tube is composed of a fluorescent screen painted in three colors, a shadow mask, and an electron gun that emits three electron beams.

A three-beam electron gun can have two types of beam arrangement: a delta arrangement and an in-line arrangement.

The delta arrangement refers to an arrangement where the sections of three electron beams form an equilateral triangle, while the in-line arrangement refers to an arrangement where they are arranged on one straight line horizontally.

The three electron beams emited from the electron gun are deflected and scan the entire fluorescent screen.

The electron beams must first pass through holes in the shadow mask which ensure the beams will strike only their corresponding phosphor colors on the screen.

One set of red, green and blue dots can reproduce any color depending on the strength of the signal received.

4.2 CIRCUIT DESCRIPTION

4.2.1 Video Amplifier (Figure 4-5)

Vedeo amplifiers consist of three amplifiers, one each for the red channel, green channel and blue channel. Those amplifiers have same functions. So, the following describes the operation of red channel amplifier.

Each amplifier performs these functions; Buffer Amplifier, Gain and Contrast Control, Pre-amplifier, DC Restoration, Background and Brightness Control, Blanking and Beam Control, Frequency Compensation and Video Driver.

a. Buffer amplifier

Video input signals are sent to Transistor Q101 through the AC Coupling with Capacitor C101.

These signals are kept at high impedance for loop-through function. The Emitter Follower of Transistor Q101 forms the connection with next Gain and Contrast Control circuit.

b. Gain and contrast control

Emitter of Q101 is connected to Gain Control Potentiometer VR104, Contrast potentiometer and Transistor Q102 in series.

Gain Control potentiometer VR104 is used for adjusting the different red, green and blue gains of the CPT cathode.

Turning the CONTRAST knob on the front panel changes the base voltage of Transistor Q102 to control the contrast of the picture.

c. Pre-amplifier

Transistors Q102 and Q103 increase the input video signals to make them strong enough to drive Video Amplifier Transistors Q107 and Q108. The collector of Transistor Q103 is connected to Transistor Q104, which converts the impedance from heigh level to low level for the next AC coupling.

d. DC restoration

By suppling the DC restoration timing signals from the SYNC circuit to the base of Transistor Q105, output signals from AC coupling capacitor C105 are kept constant thus maintaining the consistency of the black level of the screen. Collector output of Q105 is sent to the base of Transistor Q106, which converts the impedance from high to low for driving Video Amplifier Transistor Q108.

e. Background and brightness control

Brightness control voltage, which controls the black level of the screen, is supplyed to the emitter of

Transistor Q105, and adjusted by Background potentiometer VR102 and the BRIGHTNESS knob on the front panel.

VR101 makes fine adjustment in the brightness of the background and the Zener Diode on the CPT socket board makes rough adjustment. VR102 adjusts the different brightness gains (Red, Green and Blue) of the in-line jun type of CPT.

f. Blanking and beam control

HV BLANKING signals from the SYNC circuit makes Transistor Q402 cut off and erase the raster during retrace periods by making video amplifier transistors Q107 and Q108 cut off.

BEAM ON/OFF switches makes the red, green and blue beams cut off individually.

g. Frequency compensation and Video driver

Transistors Q107 and Q108 are used for the video amplifier to drive the CPT cathode. Base input of transistor Q107 is converted to a high voltage for driving the CPT cathode directly.

High voltage signals, whose frequency characteristics deteriorate, are compensated by Coils L101 and L102, Registers R127 and R128, and Capacitors C111 and C118.

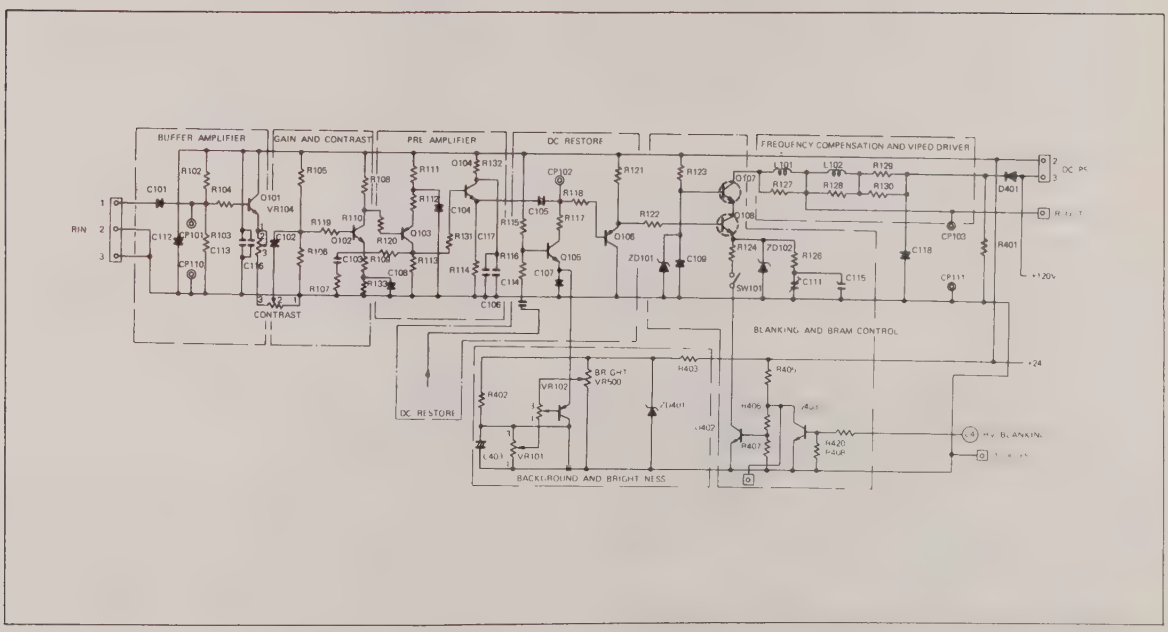


Figure 4-5 Video Amplifiers

4.2.2 Synchronizing Circuit (Figure 4-6)

The synchronizing circuit is composed of a synchronizing separator and a synchronizing processor.

a. Synchronizing separator

The synchronizing separator is composed of an input amplitier (Q451, Q452, Q453), a signal detector (Q454, Q455) and an output amplifier (Q456).
The composite video signal (SYNC IN) is amplified by the input amplifier.
The synchronizing signal (H.V. SYNC) is separated from the composite video signal by means of the signal detector, and the amplified signal is supplied to the synchronizing processor.

b. Synchronizing processor

The synchronizing processor is composed of a vertical synchronizing control circuit, a blanking signal generation circuit, a DC restoration circuit and a horizontal delay control circuit.
The vertical synchronizing control circuit separates the vertical synchronizing signal (V. SYNC) from the synchronizing signal (H.V. SYNC) by means of a monostable multivibrator (IC451) and NAND gate (IC452).
The output of the NAND gate generates the V. SYNC by means of a monostable multivibrator (IC451) and an output buffer (Q457).
The blanking signal generation circuit generates a blanking signal (H.V. BLANKING) by means of a monostable multivibrator (IC453) for horizontal blanking, two monostable multivibrators (IC433, IC454) for vertical blanking, a NOR gate (IC 452) and an output buffer (Q458).
The blanking period is adjusted by turning the VR 452 for the horizontal period and the VR453 for the vertical period.
The DC restoration circuit generates a D.C restoration signals (DC RESTORE) by means of a monostable multivibrator which forms one half of IC455, a NOR gate (IC456) and an output buffer (Q459) for normal operation when the H.V SYNC is not supplied, its absense is detected by the monostable multivibrator which forms other half of IC455, a NAND gate (IC 456) is then activated, and passes an (X1) signal that is fed from the horizontal positioning control circuit.
The horizontal delay control circuit generates the proper delayed signals upon receiving a horizontal triger signal by means of a rectifier and a level changing circuit (D455, Q460), and two monostable multivibrator (IC457).

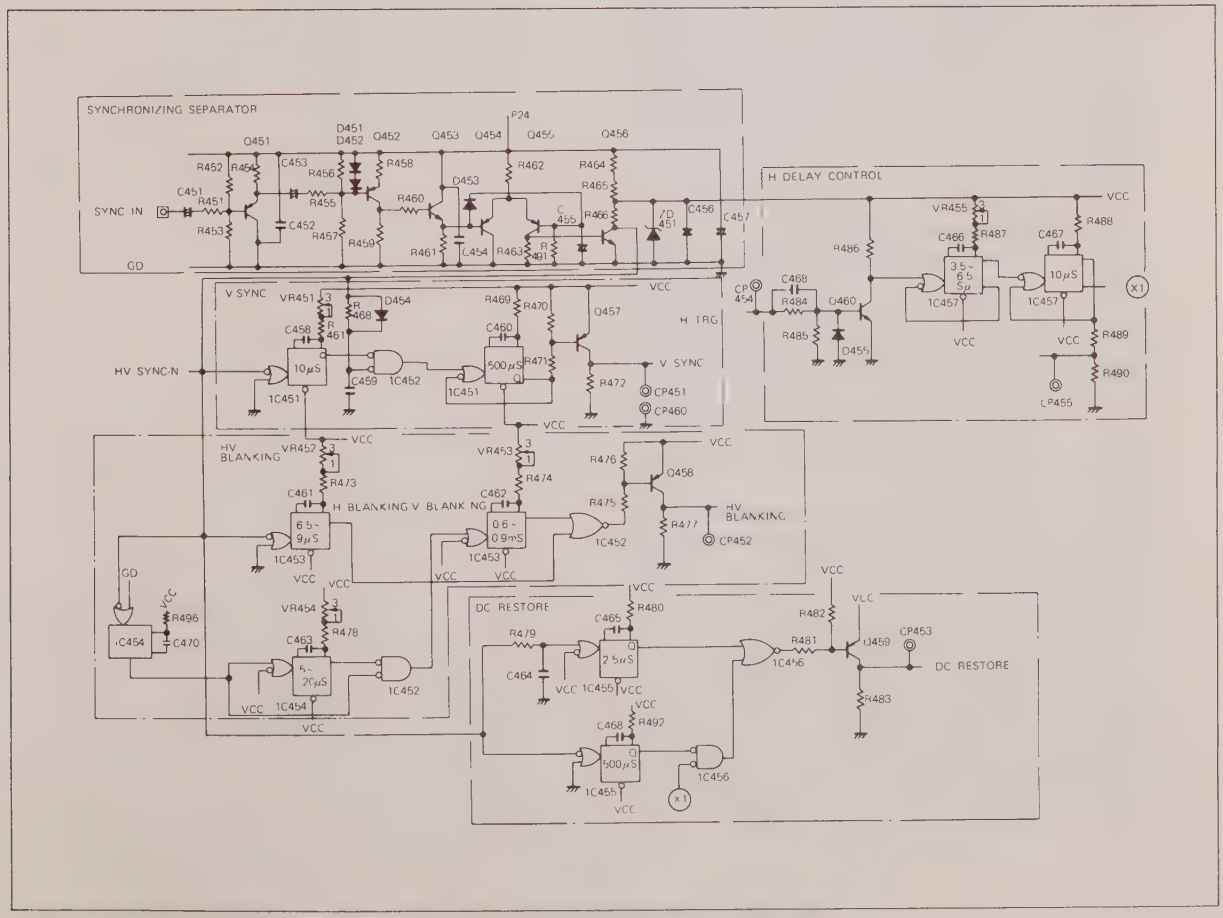


Figure 4-6 Synchronizing Circuit

4.2.3 Deflection Circuit (Figure 4-7)

The deflection circuit consists of IC501 (which contains a horizontal AFC circuit, a horizontal oscillator, a vertical oscillator and a vertical driving circuit.), a horizontal power supply adjusting circuit, a side pincushion circuit, a horizontal and vertical output circuits, and a horizontal and vertical position adjusting circuits.

a. Horizontal scanning

IC501 generates a synchronizing horizontal pulse when it is supplied with the synchronizing signal (H.V. SYNC) and the delayed signal of the horizontal output pulse (H. PHASE).

IC501 compares the H.V. SYNC and the H. PRASE, and generates the phase detecting output current according to the difference. This current is supplied to the horizontal oscillator in IC501 through the low pass filter circuit which consists of C507, C508, R507, R508 and VR501.

VR501 is used to adjust AC loop gain. The horizontal oscillator operates as a VFO (Voltage Controlled Oscillator), and it is composed of C512, R509, R510 and VR502.

The output of the horizontal osillator is supplied to the horizontal output circuit and the high voltage circuit as a triggering signal.

The horizontal oscillating pulse is amplified by transistor Q501 and the driving transformer TR501 to drive a horizontal output transistor Q504.

A horizontal deflection current flows through the damper diode, the horizontal deflection coil, L501, C519 and C520 in the first half of the scanning period and in the second half it flows through the transistor, the deflection coil, L501, C519 and C529.

Part of the current from the horizontal coil flows through the horizontal output transformer TR502.

b. Horizontal centering control

The horizontal position adjuster rectifies voltage across the secondary side winding of the horizontal output transformer TR502 by means of D504 and D505, and there by direct current is passed to the horizontal deflection coil. The position of the electron beam is adjustedby VR505 which regulates the polarity and level of the input signal.

c. Pincushion compensation and horizontal amplitude adjustment

Power source voltage applied to the horizontal deflection coil is adjusted by transistor Q505 to provide pincushion compensation and horizontal amplitude adjustment.

Vertical deflection coil current is supplied to Q502, which changes current to parabolic voltage, and also provides compensation for the voltage drop of the Q505. The current change and the amount of compensation are adjusted by VR504.

Horizontal amplitude is varied by increasing or decreasing the base voltage of Q503 by means of VR503 to control the voltage drop of Q503.

d. Vertical deflection

IC501 supplies the synchronizing vertical pulse by supplying only a vertical synchronizing signal.

The vertical oscillator determines the frequency by comparing the voltage of C604, which discharges constant current through the 4th pin, with the divided voltage of R605, R608, R609 and VR602.

Vertical linearity is improved by adding vertical deflection current to the saw-tooth wave current generated by C604. The amplified vertical pulse is generated at the 2nd pin, and is supplied to the base of vertical output transistor Q602, Vertical deflection current flows through Q601 in the first half of the scanning period, and through Q602 in the second half.

The output voltage is controlled by the negative feedback to the 3rd pin.

Vertical amplitude is adjusted by varying the feedback level by means of VR601.

e. Vertical centering control

Vertical centering is controlled by passing current to the vertical deflection coil. This current is controlled by VR604.

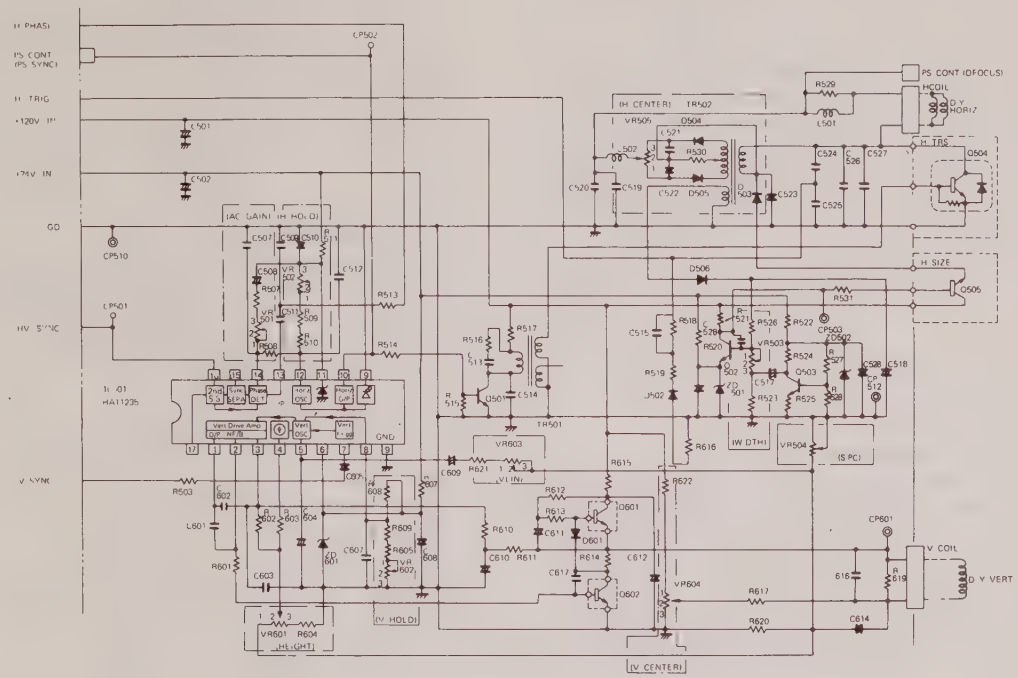


Figure 4-7 Deflection Circuit

4.2.4 High Voltage Power Supplies (Figure 4-8)

a. CPT anode voltage (+27.5kV power source)

The +27.5kV power source is composed of the switching transistor Q804, fly back transformer TR801, silicon rectifier block transformer TR801, silicon rectifier block RD801 and the high voltage stabilizing circuit. The high voltage stabilizing circuit is located on the PC board (FPS100) and everything else is located on the power supply unit.

The switching transistor Q804 is driven in synchronization with the horizontal deflection current and Q804 stays ON during the horizontal scanning period. The energy stored on the primary side of TR801 during this period is released as high voltage to the secondary side of TR801 while Q804 is OFF (horizontal blanking period).

This high voltage is then rectified by the silicon rectifier block (RD 801) which triples the voltage to 27.5kV and the voltage is supplied to the anode of the CPT.

The feadback signal from RD801 is supplied to the high voltage stabilizing circuit.

b. CPT screen grid voltage (+ 680V power source)

The constant + 680V power source is obtained through varistor RZ801 by rectifying the high voltage pulse of approximately 1000V which occurs across the collector of the transistor Q804 (on the power source unit) by means of D803 on the PC Board (FPS100) and leveling it with C808.

This voltage is divided by variable registor VR901 on the PC board (FCS100/101) and supplied to the CPT screen grid.

c. Focus voltage (+ 8,000V power source)

Like the + 27.5kV power source, the +8,000V power source is obtained by rectifying the high voltage which occurs on the secondary side of the fly back transformer TR801 by means of the silicon rectifier block RD801. This voltage is divided by the variable registor VR810 for focus setting and supplied to pin 1 of the CPT socket.

d. High voltage detection circuit

The high voltage detection circuit detects any abnormal increase in the anode voltage of the CPT and is set to operate between 29 and 31kV. When the anode voltage increases abnormally, the voltage across the capacitor C833, normally −200V, rises proportionally and this turns off Q833.

Both Q834 and Q835 are turned ON by the OFF state of Q833 and are followed by the ON state of Q722 which turns on Q723 to suppress the output of the +120V power source.

This condition is maintained in the same way as for the over current detection of the +120V power source until the operator turns off the main power source.

e. Over current limiter

The over current limiter converts the load current of the +120V power source into the voltage by means of registor R708 and supplies it to the base and the emitter of the transistor Q723, which is turned ON by this voltage when the load current is more than 1.1 to 1.3 ampere.

When Q723 is turned ON, the control circuit of the +120V power source is locked and its output is cut off.

Simultaneously Q722 is turned ON and this condition is maintained until the main power source is turned off.

Then if the over current detection circuit has been operated, AC power source must be turned ON after the causes of over current are rejected.

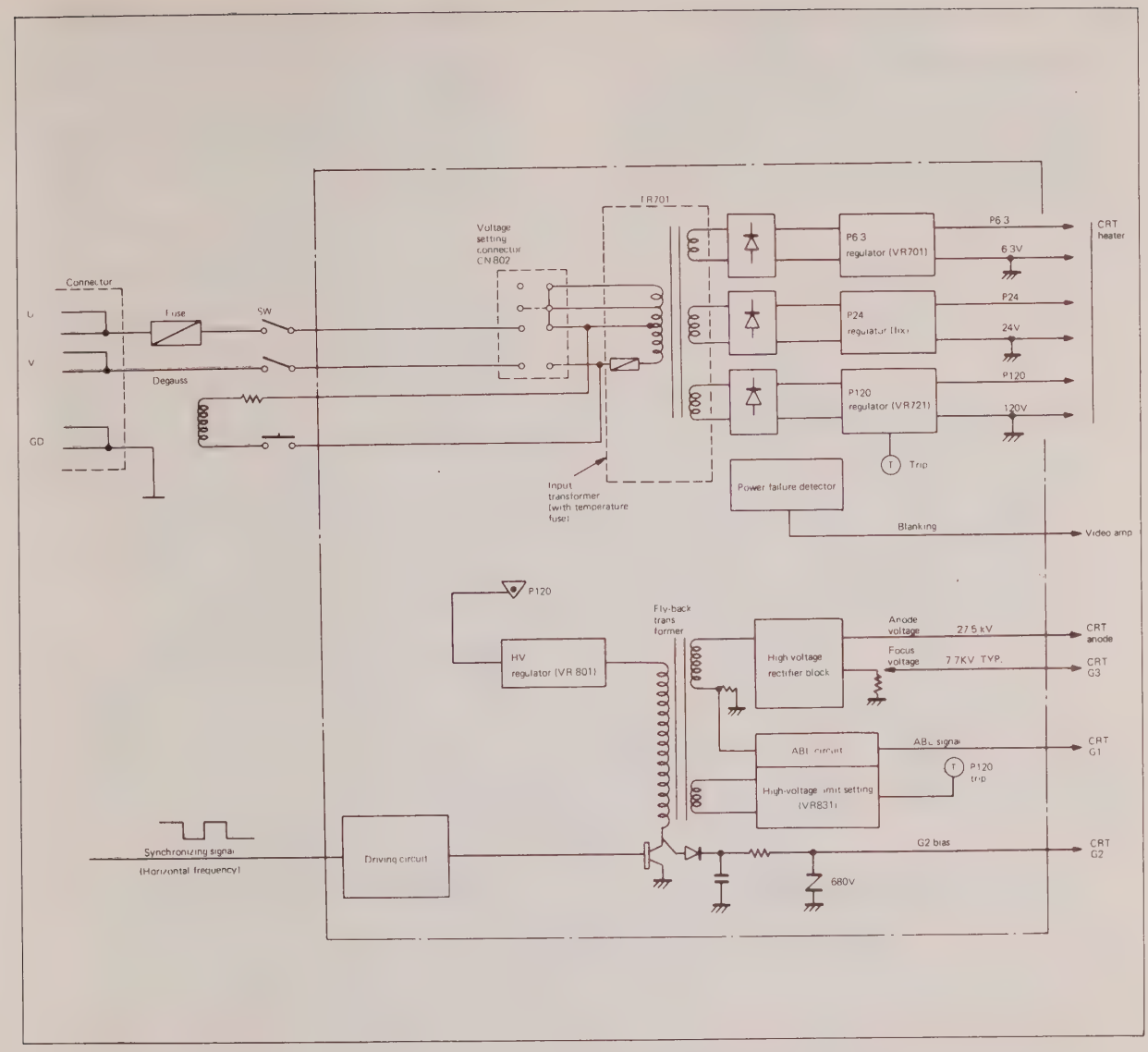


Figure 4-8 Power Supplies

4.2.5 Low Voltage Power Supplies

a. Voltage regulator P6.3 (Figure 4-9)

IC701 is a 5-volt fixed voltage (5V) IC regulator to which 1.3V voltage is added by R709, R710, and VR701 to obtain stablilized output voltage 6.3V. An overcurrent protector circuit is incorporated in IC 701, thereby voltage is limited to approximately 1A.

b. Voltage regulator P24 (Figure 4-10)

IC702 is a 24-volt fixed voltage (24V) IC regulator, to which TRS Q702 is added to obtain stabilized output voltage 24V.

The sum of voltage I_0R_{701} and Q702 B-E forward voltage ($=V_{be}$) produced in R701 is limited to within forward voltage drop ($=2V_{df}$) of D706 and D707.

$V_{be} = V_{df}$, $I_0R_{701} \leqq V_{df}$ Therefore,

$$I_0 \leqq \frac{V_{df}}{R_{701}} \leqq \frac{0.8V}{0.5\Omega} = 1.6^{A}$$ That is,

overcurrent is limited at 1.6A max. to protect parts and wirings from load short-circuit (short time).

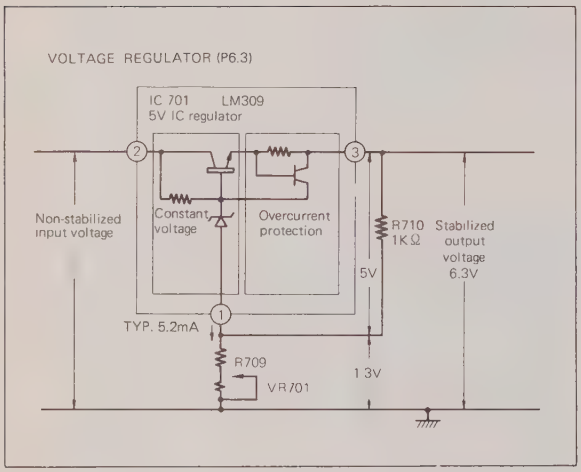


Figure 4-9 Voltage Regulator P6.3

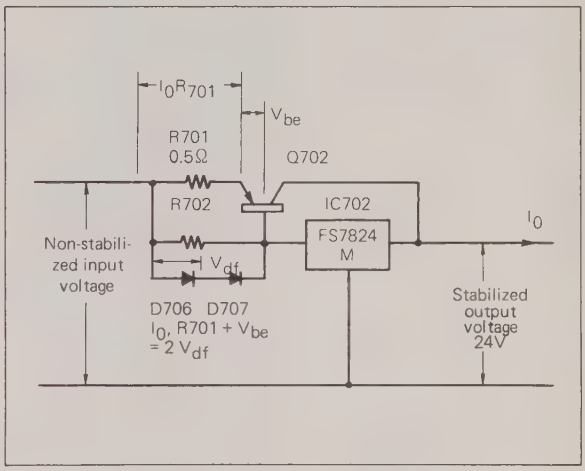


Figure 4-10 Voltage Regulator P24

c. Voltage regulator P120 (Figure 4-11)

The control circuit synchronizes voltage to synchronizing signal of the horizontal period of CPT to produce driving signal. It is amplified by Q704 to drive main TRS Q703. Output of Q703 (emitter of Q703) becomes high switching wave (=V_i) during the Ton period and low one (OV) during the Toff period as shown above. The switching wave forms are smoothed by L701 and C706 to obtain Stabilized output voltage V_0. Q705 serves to reduce storage time when shifting main TRS from ON to OFF. Load current is converted to voltage by R708 to be detected and limited to 1 A. Limit current is set by VR722. Latch circuit in the control circuit operates when overcurrent is detected, trips switching, and nullifies output voltage. When overvoltage detector receives the signal from anode voltage, switching is tripped to nullify output voltage. To release tripping, once turn off the power source switch (approx. 10 sec.). When tripping is resumed, the power source unit must be replaced.

power source unit must be replaced.

Input voltage V_i

Output voltage V_0, Toff are controlled to establish the following relation:

$$V_0 = \frac{Ton}{Ton + Toff} Vi \quad \ldots\ldots\ldots \quad (1)$$

$Ton + Toff = T_H$ horizontal period constant

That is, ratio of Ton is regulated according to input voltage V_i so that output voltage V_0 may be constant.

Voltage is set by VR721. Actual typical values are:

V_i = 150V

V_0 = 120V. and

T_H = 50 μs (at F_H = 20kHz). From equation (1)

Ton ratio then (= Ton/T_H) is

$$Ton/T_H = \frac{V_0}{V_i} = \frac{120V}{150V} = \frac{40\mu s}{50\mu s} = 0.8$$

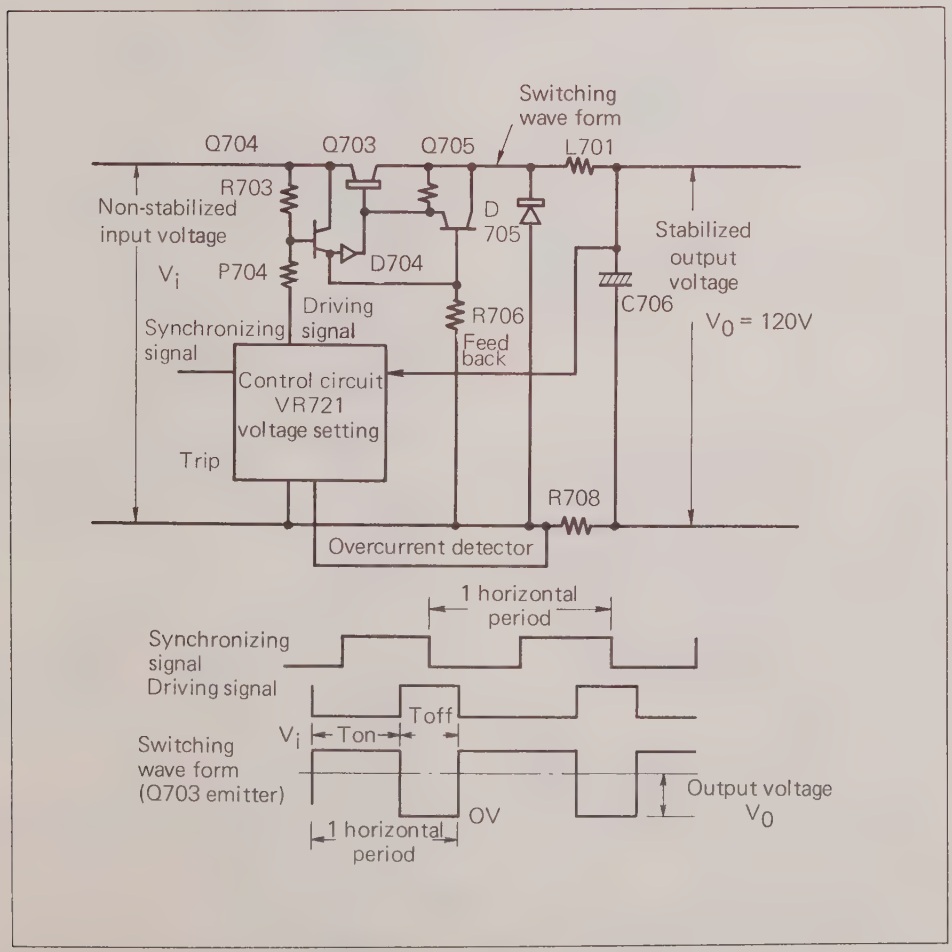


Figure 4-11 Voltage Regulator P120

5. ADJUSTMENT AND TEST

5.1 FRONT PANEL

5.1.1 Degaussing

Degaussing will be required when misconvergence or poor color purity appear on the screen. This monitor is equipped with a built-in degaussing coil and an internal shield, however, use of external hand-held degaussing coil may be necessary for other parts like cabinet, which may have been magnetized during handling and transportation.

a. Built-in degaussing

By depressing the DEGAUSS switch, located second from the left on the front panel of the unit, CPT and its internal shield will be degaussed. Keep the switch depressed until the color distortion disappears, which is highly recommended at the time of installation.

b. External degaussing

Turn on the hand-held degaussing coil at a distance of 3 feet (1m) from the screen. Move it to within about 4 inches (10cm) of the top and side of the screen. Make a slow circular movement a few times. Then move the coil gradually away from the screen and turn off the coil.

5.1.2 Contrast

CONTRAST control on the front panel increases or decreases the AC gains of red, green and blue signals. By turning clockwise, AC gain (contrast) of three colors is increased.

5.1.3 Brightness

BRIGHTNESS control increases or decreases the DC level of red, green and blue signals (brightness of raster of red, green and blue). By turning clockwise, DC level of three colors is increased.

5.2 PC BOARD

5.2.1 Deflection Circuit

a. Horizontal hold (VR502)

Horizontal hold potentiometer H. HOLD (VR502) adjusts the horizontal deflection frequency. When picture is unstable and moves to the left, turn H. HOLD counterclockwise. While picture moves to right, turn H. HOLD clockwise. Still, picture remains unstable after above adjustment, turn AC GAIN potentiometer VR501 counterclockwise.
If AC GAIN adjustment does not work well, turn AC GAIN clockwise and repeat the above adjustment.

b. Vertical hold (VR602)

Vertical hold potentiometer V. HOLD (VR602) adjusts the vertical deflection frequency. When picture is not stable and moves downwards, turn V. HOLD clockwise. While picture moves upwards, turn V. HOLD counterclockwise.

c. Horizontal centering (VR505)

Horizontal centering potentiometer H. CENTER (VR505) adjusts the horizontal center of picture.
When picture is displayed to the right of the center, turn H. CENTER counterclockwise by moving picture to the left. Turning H. CENTER clockwise moves picture to right.

d. Vertical centering (VR604)

Adjust the horizontal center of picture.
Rotate the V. CENTER pot (VR604) counterclockwise when the picture is displayed above the center. Rotate the pot clockwise when picture is displayed below the center.

e. Vertical sync separate (VR451)

Adjust the potentiometer to get stable vertical sync from composite sync signal (H and V).

f. Horizontal sync separate (VR454)

Adjust the potentiometer to get stable horizontal sync from composite sync signal (H and V).

g. Horizontal blanking (VR452)

Adjust the potentiometer to erase horizontal retrace line, if necessary. By turning counterclockwise, the raster of left side is disappeared gradually.

h. Vertical blanking (VR453)

Adjust the potentiometer to erase vertical retrace line, if necessary. By turning counterclockwise, the raster of upper side is disappeared gradually.

i. Height (VR601)

Height control potentiometer HEIGHT (VR601) adjusts the vertical size of picture.
Turn HEIGHT clockwise to make picture height increase.

j. Width (VR503)

Width control potentiometer WIDTH (VR503) adjusts the horizontal size of picture.
Turn WIDTH clockwise to make picture width increase.

k. Side pincushion (VR504)

Side pincushion control potentiometer VR 504 adjusts the vertical lines to be straight and unbowed. By turning S-PC clockwise or counterclockwise, the side distortion of the picture is corrected.

l. Horizontal linearity (L602)

Horizontal linearity inductor L602 adjusts the horizontal linearity of the picture. By turning the inductor clockwise or counterclockwise, the interval of horizontal dots is adjusted to make the horizontal lines straight.

m. Vertical linearity (VR603)

Vertical linearity potentiometer VR 603 adjusts the vertical linearity of the picture. By turning the potentiometer clockwise or counterclockwise, the interval of rasters is adjusted to make the vertical lines straight.

n. Horizontal phase (VR455)

Adjust the pot to make picture to be centered within raster. By rotating the pot clockwise, the picture is displayed to left of the center.

5.2.2 Video Circuit

a. Background brightness control

Background brightness control potentiometers VR101, VR201 and VR301 (for RED, GREEN and

BLUE, respectively) make fine adjustments in the brightness of the background.
By turning the potentiometer clockwise, the background becomes to be more bright.

b. Brightness gain control

Brightness gain control potentiometers VR102, VR202 and VR302 (for RED, GREEN and BLUE, respectively) are used for adjusting the different brightness gains in red, green and blue signals.

c. Contrast control

Contrast control potentiometers VR104, VR204 and VR304 (for RED, GREEN and BLUE, respectively) adjust the input signal gains different in red, green and blue signals.

d. Beam switch

Beam on/off switches SW101, SW201 and SW301 (for RED, GREEN and BLUE, respectively) are used for turning the beams of red, green or blue on and off.

e. White balance adjustment

- Turn the BRIGHTNESS on the front panel to minimum, fully counterclockwise.
- Turn the CONTRAST on the front panel to its midpoint.
- Adjust background brightness potentiometers VR101, VR102 and VR103 in control drawer until background becomes white.
- Rotate the BRIGHTNESS control to maximum position, fully clockwise.
- Adjust brightness gain potentiometers VR102, VR202 and VR302 until screen is white.
- Rotate the CONTRAST control clockwise until the picture is just displayed.
- Adjust gain potentiometers VR104, VR204 and VR304 until the picture is white.
- Rotate the CONTRAST control until the picture is displayed to the medium luminance.
- Adjust gain potentiometers VR104, VR204 and VR304 until the picture becomes white.
- Confirm that the picture is always white regardless of CONTRAST control operation.

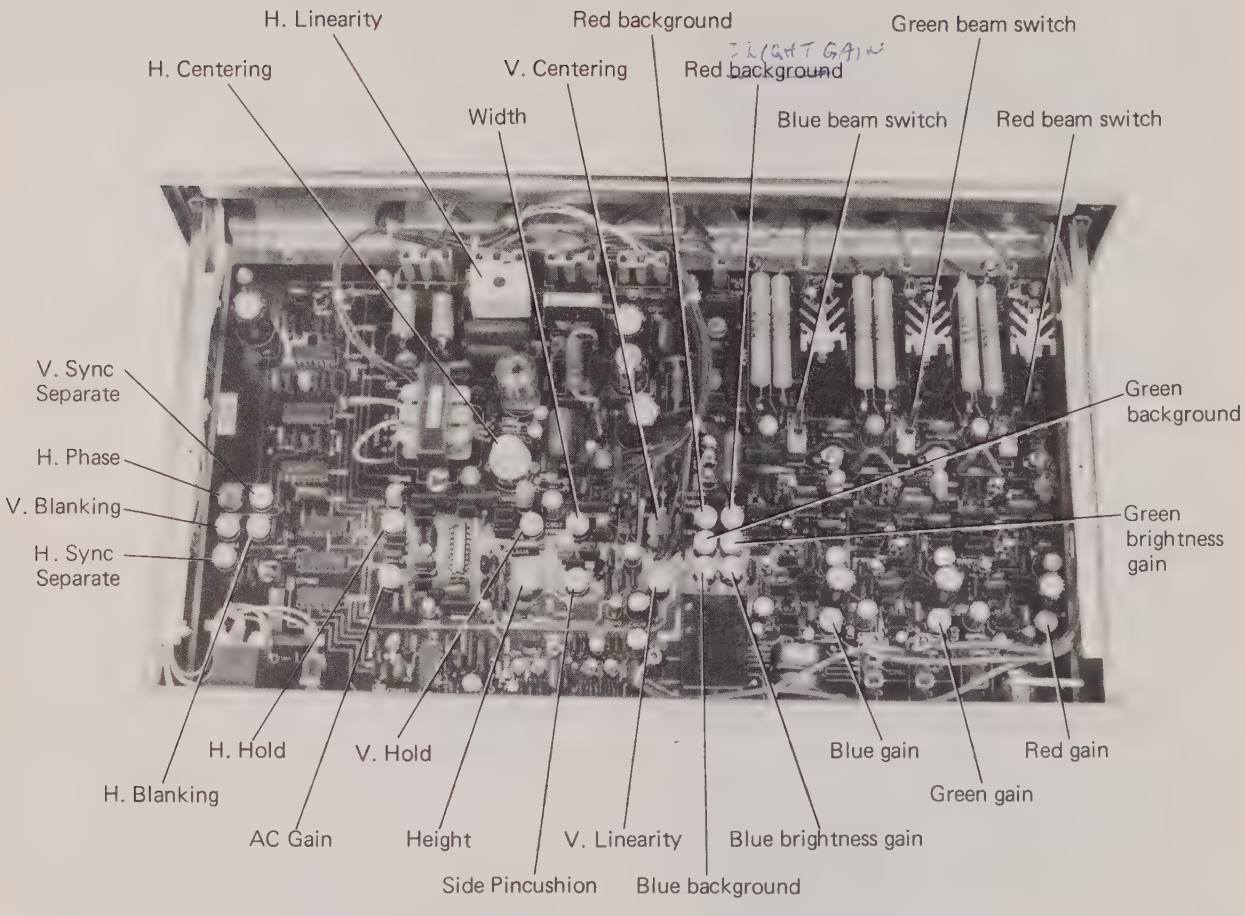


Figure 5-1 Control Drawer

5.3 POWER UNIT (Figure 5-2)

5.3.1 Low Voltage (P120, P6.3)

The variable resistors ⑥ and ⑧ adjust the +120V and +6.3V power supplies, respectively. By turning clockwise, the power supplies are raised, and can be checked with check pins ② and ⑤.

5.3.2 High voltage (P680)

The variable resistor VG2 ⑩ adjusts the screen grid voltage. This voltage should be adjusted between 650V and 670V by checking with check pin ⑨.

5.3.3 Over current detection

The variable resistor OC ⑦ adjusts the set value which detects over current.
At the normal use, this resistor should be set at the most clockwise position.

5.3.4 Focusing

The variable resistor FOCUS VR ① adjusts the focus of CPT.
Set the best focus position.

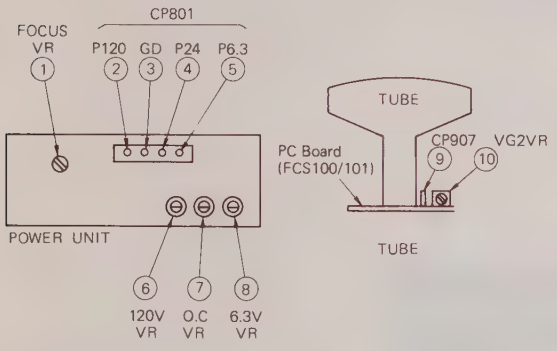


Figure 5-2 Arrangement for Controls and Check Pins

5.4 TUBE

This tube is of an in-line gun type, and normally needs no adjustment (of purity, convergence, for example) by the user. If any adjustment is required of this tube, it is requested to return it to the factory without trying to adjust it by yourself.

Top views of the monitor and magnetic ring alignment are shown in Figures 5-3 and 5-4.

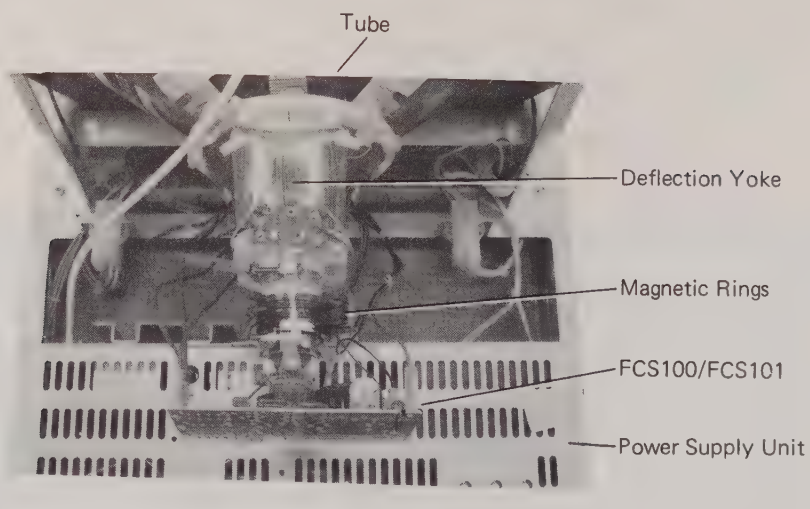


Figure 5-3 Top view of Monitor

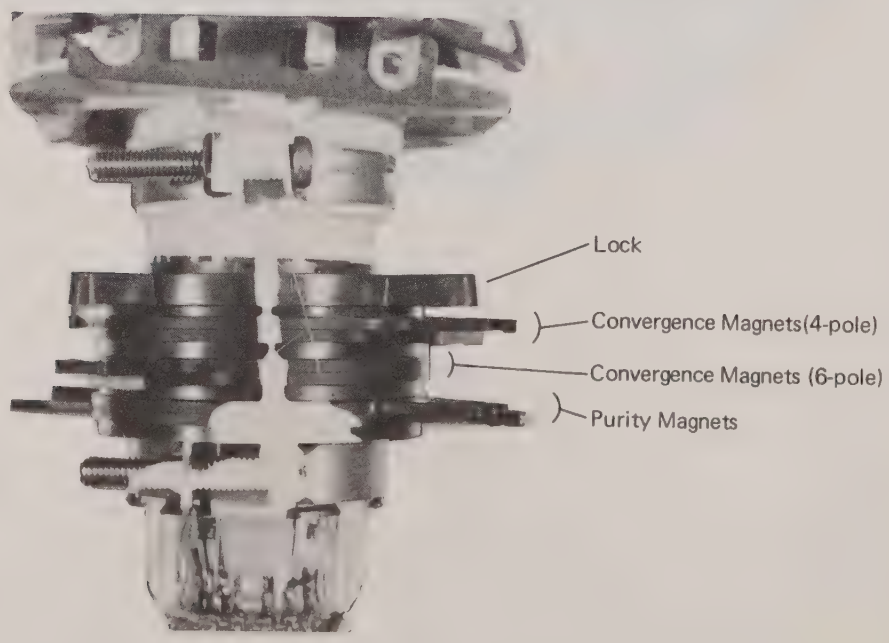


Figure 5-4 Magnetic Rings

5.4.1 Purity

a. Purity adjustment for vertical center

Adjust the HEIGHT control to get the minimum height of the picture which will form a narrow horizontal band in the center of the screen.

1) Do not turn the purity magnet if the horizontal band coincides with the horizontal line in the center of the screen as shown in Figure 5-5. In this

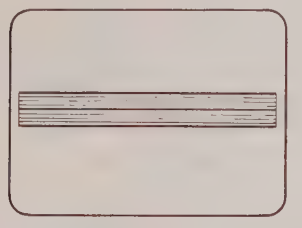


Figure 5-5

case, the purity magnet knobs should be set at 3 o'clock and 9o'clock, respectively, as shown in Figure 5-6.

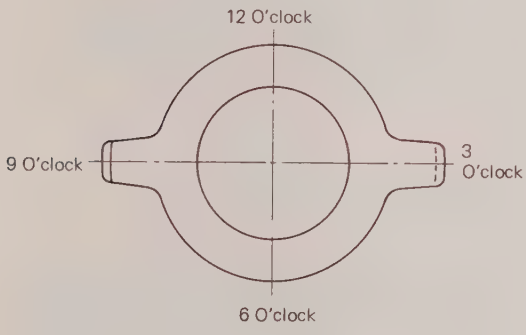


Figure 5-6

2) If the horizontal band does not coincide with the horizontal line in the center of the screen, move each set of purity magnet knobs so that one set points to 12 o'clock and the other to 6 o'clock as shown in Figure 5-7.

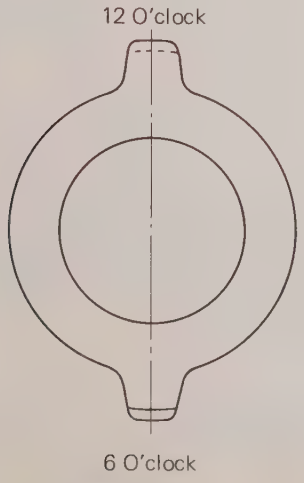


Figure 5-7

Then, gradually adjust them, making sure that the angles remain equal, until the horizontal band coincides with the horizontal center line as shown in Figure 5-8.

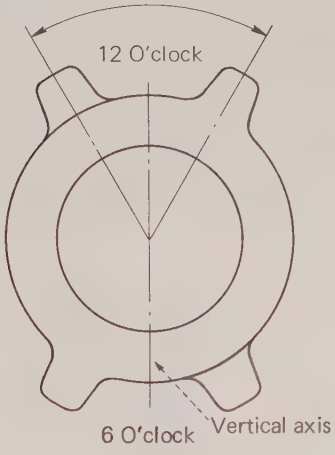


Figure 5-8

b. Purity adjustment at the screen center

1) Put a monoscope pattern or blanking raster on the screen with a single beam from the green electron gun.
2) Move the deflection yoke backward or forward along the tube axis, until a green ball appears on the screen.
3) If the horizontal band coincides with the horizontal line in the center of the screen as shown in Figure 5-5, move the purity magnet knobs so that one set points to 3 o'clock and the other to 9 o'clock, keeping the angles equal (Figure 5-9),

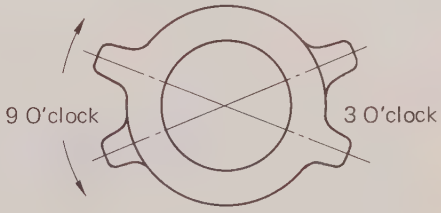


Figure 5-9

until the green ball should be in the center of the screen as shown in Figure 5-10.

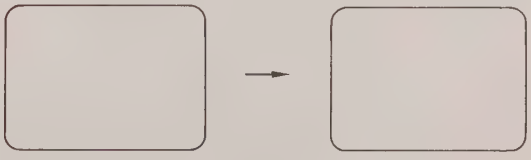


Figure 5-10

4) If the horizontal band does not coincide with the horizontal line in the center of the screen, perform the adjustment in a. 2). Then, move both sets of knobs simultaneously, keeping the angle equal,

until the green ball is in the center of the screen as shown in Figure 5-10.

5) Use a microscope to make sure that the electron beam is striking the exact center of the screen.

c. Purity adjustment for the entire screen

1) Loosen the screw of the deflection yoke and gradually move it backward along the tube axis until the entire screen becomes green. If the deflection yoke is closely posistioned to the neck, move it forward as close as posible to the funnel. Then, using a microscope, check to make sure that the electron beam is squarely striking the phosphor dots on all sides of the screen.

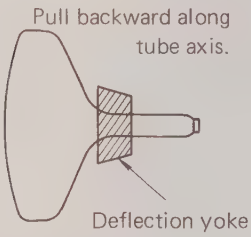


Figure 5-11

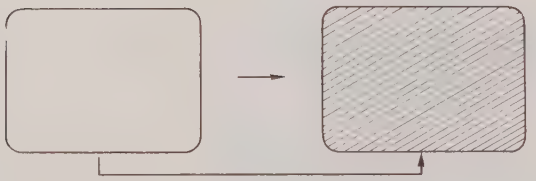


Figure 5-12

2) Adjust the purity of the other two colors (Red and Blue), in the same way.

3) Recheck and readjust the vertical center of the horizontal band and repeat the same operation according to the same steps mentioned in c. 1) and c. 2).

4) Tighten the screw of the deflection yoke with a torque screwdriver set at a torque of 14kg·cm.

5.4.2 Stalic Convergence

a. Adjust the cathode current so that the width of the crosshatch lines (Red, Green and Blue) is from 6 to 8 phosphor dots.

b. Adjust focus voltage for the best focus.

c. Switch the green signal to the red and blue patterns, and repeat the same operations.

d. Carefully watch the intersection of cross-hatch pattern at the center of the screen and gradually move the knobs of two 4-pole magnets until there is no misconvergence between red and blue vertical lines as shown in Figure 5-13.

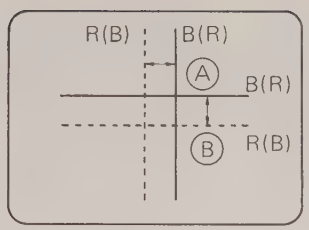


Figure 5-13

e. Keep the angles of two 4-pole magnets constant and gradually move the knobs simultaneously until there is no misconvergence between red and blue horizontal lines as shown in figure 5-13.

f. Put the R, G and B cross-hatch pattern on the screen again.

g. Gradually move the kobs of two 6-pole magnets until there is no misconvergence among the red, green and blue vertical lines at the center of the screen as shown in Figure 5-14.

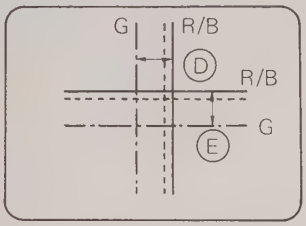


Figure 5-14

h. Then, keeping the angle of two 6-pole magnets constant, gradually move them at the same time until there is no misconvergance among the red, green and blue horizontal lines at the center of the screen as shown in Figure 5-14.

i. Repeat the above steps (d. through h.) to adjust the convergence at the center of the screen.

Reference: Changes in Beam Direction by Purity Magnet

This section describes the changes in beam direction caused by moving the purity magnet, 4-pole magnets and 6-pole magnets.

The correction for static convergance and color purity required in this tube can be realized by permanent magnets. The purity magnets consist of magnetized metal rings.

Two types of magnets are recommended for static convergence, one is a 4-pole magnet which moves the outside beams equally in opposite directions and the other is a 6-pole magnet which moves the outside beams equally in the same direction, as shown in Figure 5-15 and Figure 5-16, respectively.

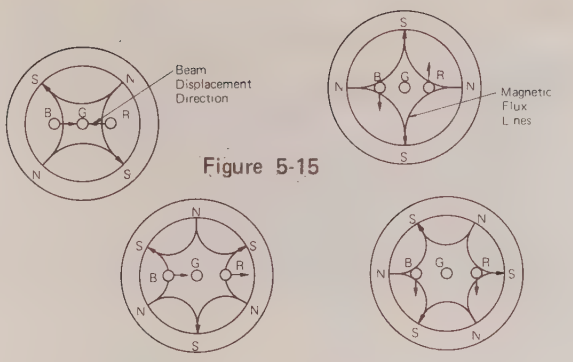


Figure 5-15

Figure 5-16

Barium ferrite magnets with a permeability close to 1.0 are recommended to avoid interference between the magnets and the deflection yoke.
Both the 4-pole and 6-pole magnets have no magnetic field at their center so the center electron beam is unaffected. These magnet can be used to converge the outside beams to the center beam without substantially moving the center beam, and thus no magnets are required in the electron gun itself. Consequently, the beams can be converged with practically no interference and a minimum amount of bending of the beams. Therefore, there is very little distortion in the shape of the individual beams.

5.4.3 Dynamic Convergence

a. Tilt the deflection yoke upward or downward by turning the adjustment handle of the deflection yoke so that the misconvergence between the red and blue vertical cross-hatch lines at 1 and 1', and that between the red and blue horizontal cross-hatch lines at 2 and 2', are minimize as shown in Figure 5-17.

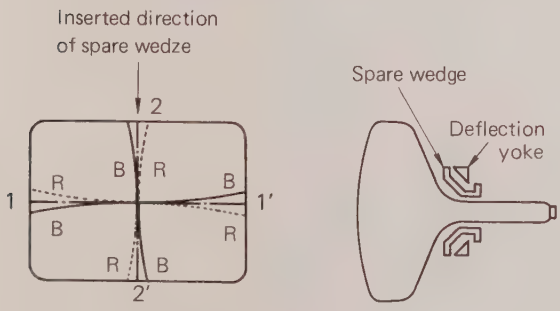
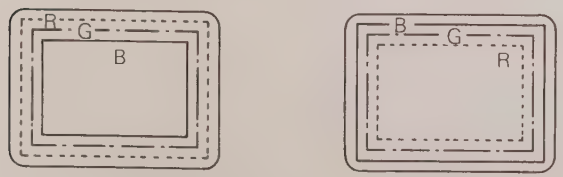


Figure 5-17

b. After making the adjustment in a., residual misconvergence pattern will be either (a) or (b) as shown in Figure 5-18.



(a) (b)

Figure 5-18

If the red cross-hatch line deviates outside the blue cross-hatch line in the peripheral area as shown in Figure 5-18 (a), move the deflection yoke counterclockwise (as viewed from the top of the tube) by rotating the adjustment handle of the deflection yoke, in order to minimize the misconvergence between the red and blue horizontal lines at the top and the bottom of the screen as well as the misconvergence between the red and blue vertical lines at the left and right of the screen.
If the blue line deviates outside the red line as shown in Figure 5-18 (b), move the deflection yoke clockwise (as viewed from the top of the tube).

c. Repeat steps a. and b. above to adjust the convergence.

d. After convergence is adjusted, put the blanking signal for making the white raster on the screen. Then, check the purity and vertical centering position*1 with the tube placed in a north-south direction. (change the tube direction to an east-west direction*2, and perform degaussing respectively).
*1: The equivalent magnetic field can be used. In this case, check the purity without changing the tube direction.
*2: When the equivalent magnetic field is applied, degaussing is necessary.

5.4.4 Fixing the Magnets

a. Be careful not to move the 4-pole, 6-pole and purity magnets, and fix the magnet assemblies with respective locking ring.

b. Apply white paint on the magnet assemblies in order to prevent them from moving.

5.4.5 Final Fixing

a. A silicone adhesive sealer should be put on the wedge before it is inserted as shown in Figure 5-19.

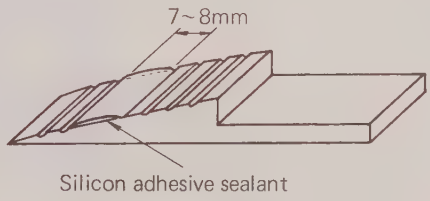


Figure 5-19

b. Taking care not to move the deflection yoke, insert three wedges at an angle of approximately 120° at a strength of 6 to 8 kg·cm as shown in Figure 5-20.

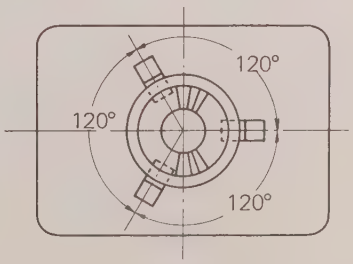


Figure 5-20

c. After inserting the wedge, raise the end of each wedge and drip the silicone adhesive sealer between the wedge and the funnel as shown in Figure 5-21.

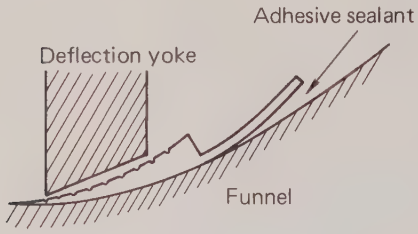


Figure 5-21

d. Apply a piece of glass fiber tape to each wedge as shown in Figure 5-22.

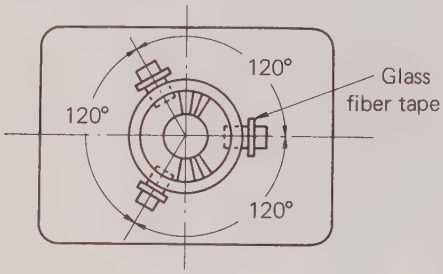


Figure 5-22

5.5 REPLACEMENT AND ASSEMBLY

5.5.1 PC Board Unit

The following procedure describes the removal of the PC Board Unit.

1) Remove the AC power connector CN002 and the signal connector CN003 at the back of the monitor.
2) Insert the key into the key hole on the front panel of the monitor, turn the key to the "OPEN" position and pull out the drawer.
3) Remove the eight connectors, H-COIL, PS-CONT, DC-PS, V-COIL, BLK-CTL, B-OUT, G-OUT and R-out, inside the drawer.
4) Remove the six screw on both side of the drawer which fasten the drawer to the rails.
5) Remove the drawer by pulling it forward.

To install the drawer, reverse the previous procedure from 1) to 5).

5.5.2 Power unit

The following procedure describes the removal of the power unit.

1) Remove the anode cap from the tube by pulling up its vinyl cover and twisting it to the right.
2) Remove the three connectors, CN801, CN803, CN804, at the back of the power unit.
3) Remove the two screws at both side of the unit which fasten the unit fo the base.
4) Remove the power unit by pulling it up.

To install the unit, reverse the previous procedure from 1) to 4).

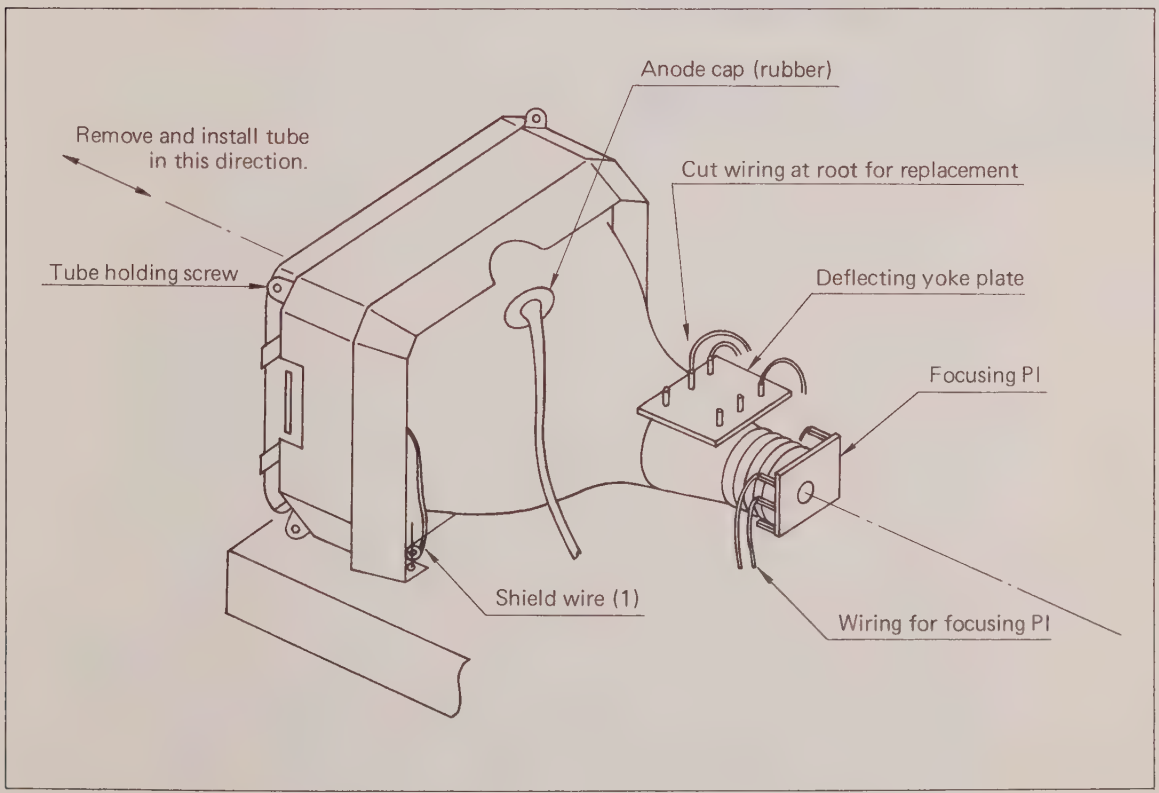
5.5.3 Tube

a. Precaution

1) The tube is made of glass, and therefore proper care should be taken when removing, installing and carrying it.
2) Avoid touching a knob on the power supply unit when removing and reinstalling the tube.
3) Be sure to remove the wiring and anode cap at the rear of the tube before removing the tube.
4) Avoid contact with the anode cap because of high voltage involved.
5) Care should be taken not to damage the tube face.

b. Procedure

1) Select a new tube and focusing PI (FCS100/101) as designated in the specifications. (When laying the tube down, be sure to place it on a special support.)
2) Remove the focusing PI from the rear of the tube.
3) Cut the wiring of the deflecting yoke plate (located at the rear of the tube) at its root.
4) Remove the anode cap on the back of the tube. (Note: proper care should be taken since a high voltage can remain after the power has been turned off.)
5) Disconnect the shield wire from the back of the tube.
6) Turn out four tube holding screws on the front and pull the tube forward.
7) Remove the shield wire from the tube and install it on the new tube.
   Note, however, that if tube sizes differ, then an appropriate shield wire must be selected.
8) Install the new tube in place and fasten the shield earth wire.
9) Replace the focusing PI removed in step 2) with a new one. (Note that at this time, the wiring should be in original position.)
10) Install the focusing PI on the tube.
11) Connect the wiring which was cut in step 3) to the newly installed tube.
12) Attach the anode cap.
13) Position the tube accurately using a special tool.



5.6 OPTIONS

5.6.1 Mechanical Options

Cabinet type —— A rack-mount type monitor installed in a cabinet, permitting the main body to be places on a desk.

Rack-mount type with slide —— A rack-mount type monitor fitted with a slide 110QD-20-2 (manufactured by Jonathan).

5.6.2 Tube Options

Long-persistence phosphor tube —— A Tube coated with a type of phosphor that gives longer persistence than normal type. The table below shows the comparison between them:

	Normal type	Long-persistence type
Red	1ms ~ 100ms	1ms ~ 100ms
Green	10μs ~ 1ms	100ms ~ 100sec
Blue	10μs ~ 1ms	10μs ~ 1ms

5.6.3 Functional Options

BNC connectors with "loop through" —— Those with a BNC-type coaxial connector used as an input signal connector and an output connector added for CRT connection.

BNC connectors with loop-through and channel A/test select —— Those with a BNC connector and an additional test input connector and its change-over switch added to the above option.

6. MAINTENANCE

This chapter describes both preventive and corrective maintenance. Preventive maintenance is mainly concerned with monitor cleaning.
Corrective maintenance deals with fault isolation in reference to the waveforms.
Before beginning maintenance work, always make sure that AC power is turned off.
Maintenance personnel should refer to this chapter when carrying out maintenance procedure.

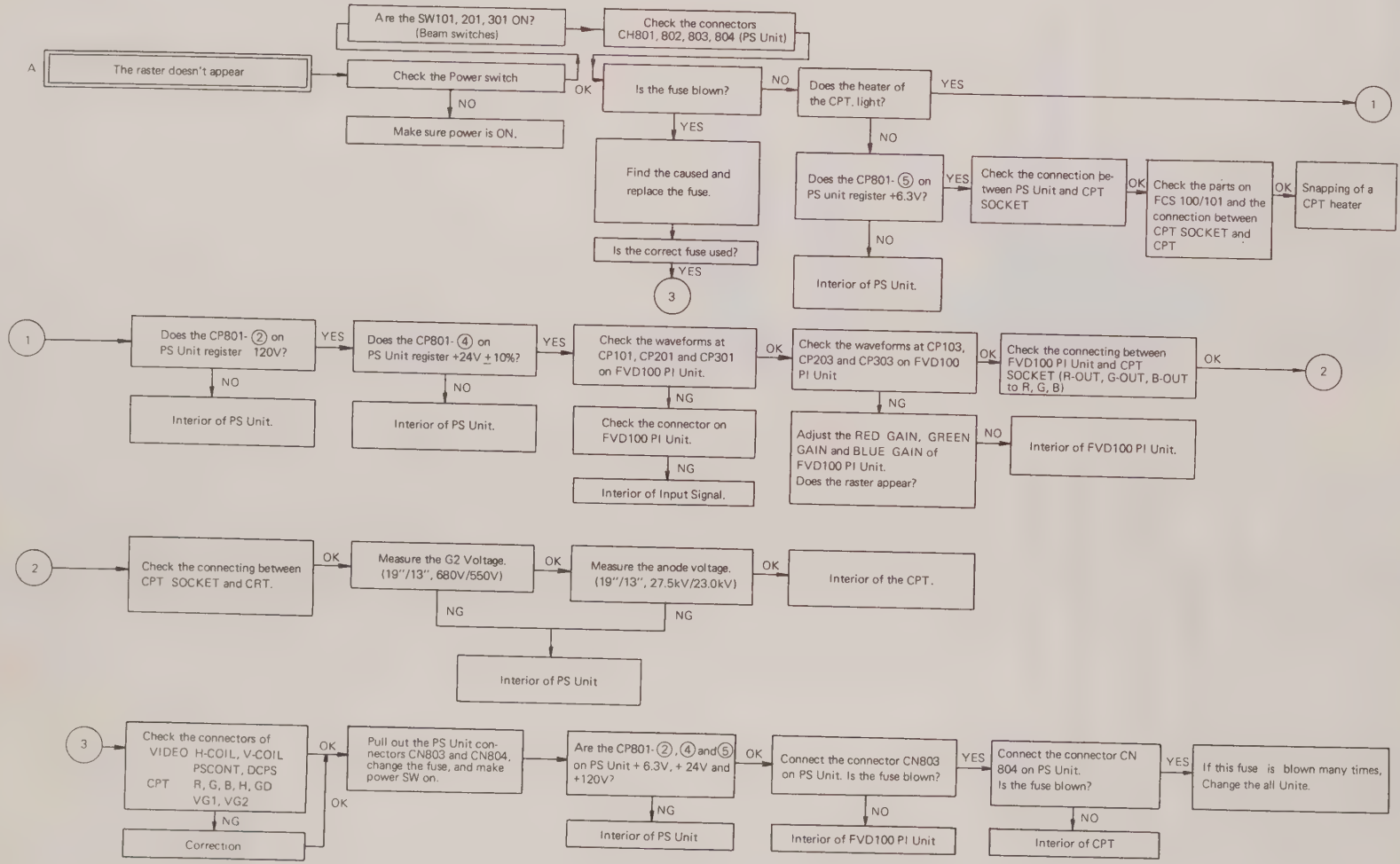
6.1 PREVENTIVE MAINTENANCE

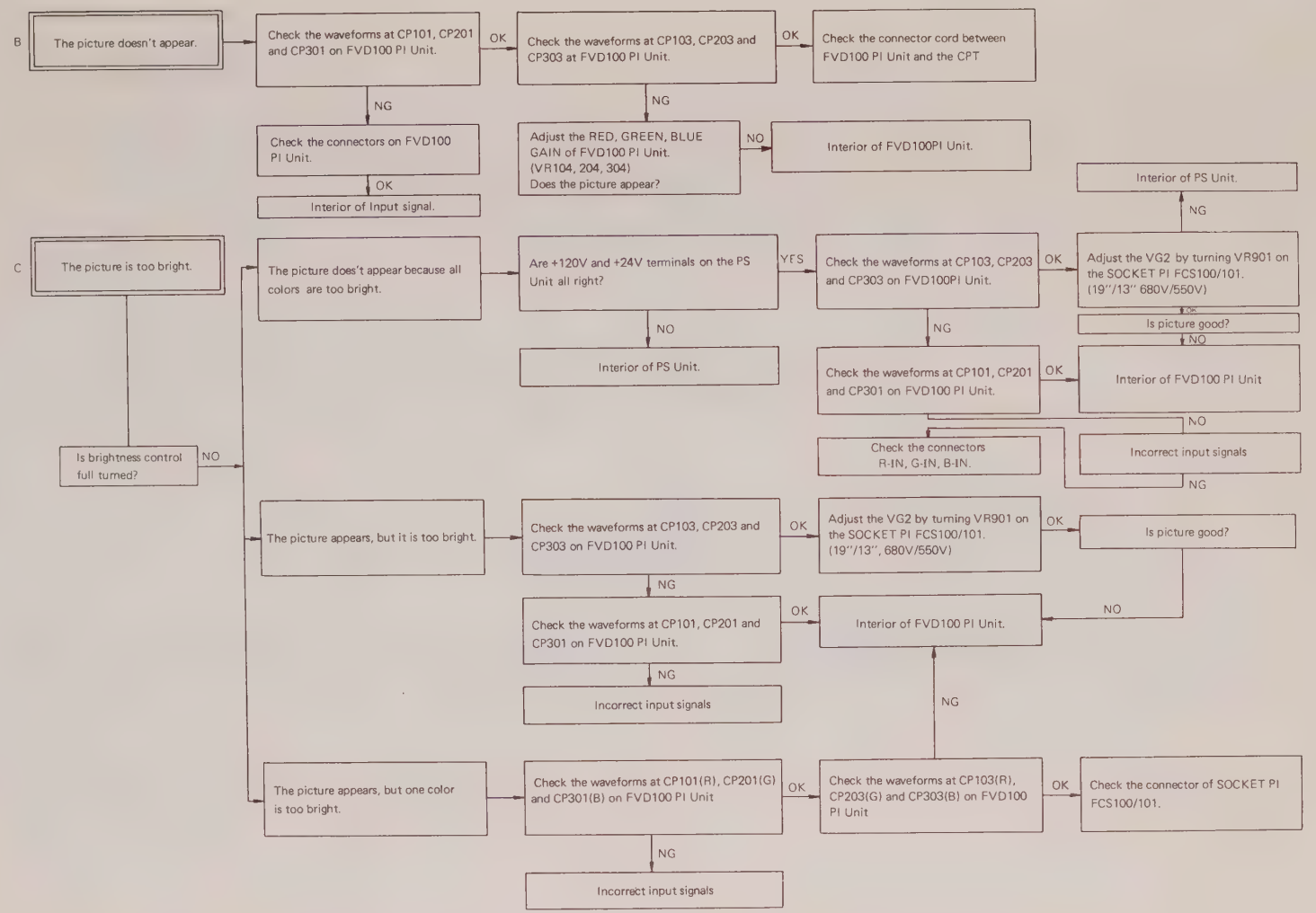
Preventive maintenance consists of cleaning the inside of the chassis, cleaning the screen face and checking the cable connections.
Environmental conditions will determine how often cleaning has to be done.
Maintenance personnel are urged to refer to Section 2.1 "Installation Precautions".

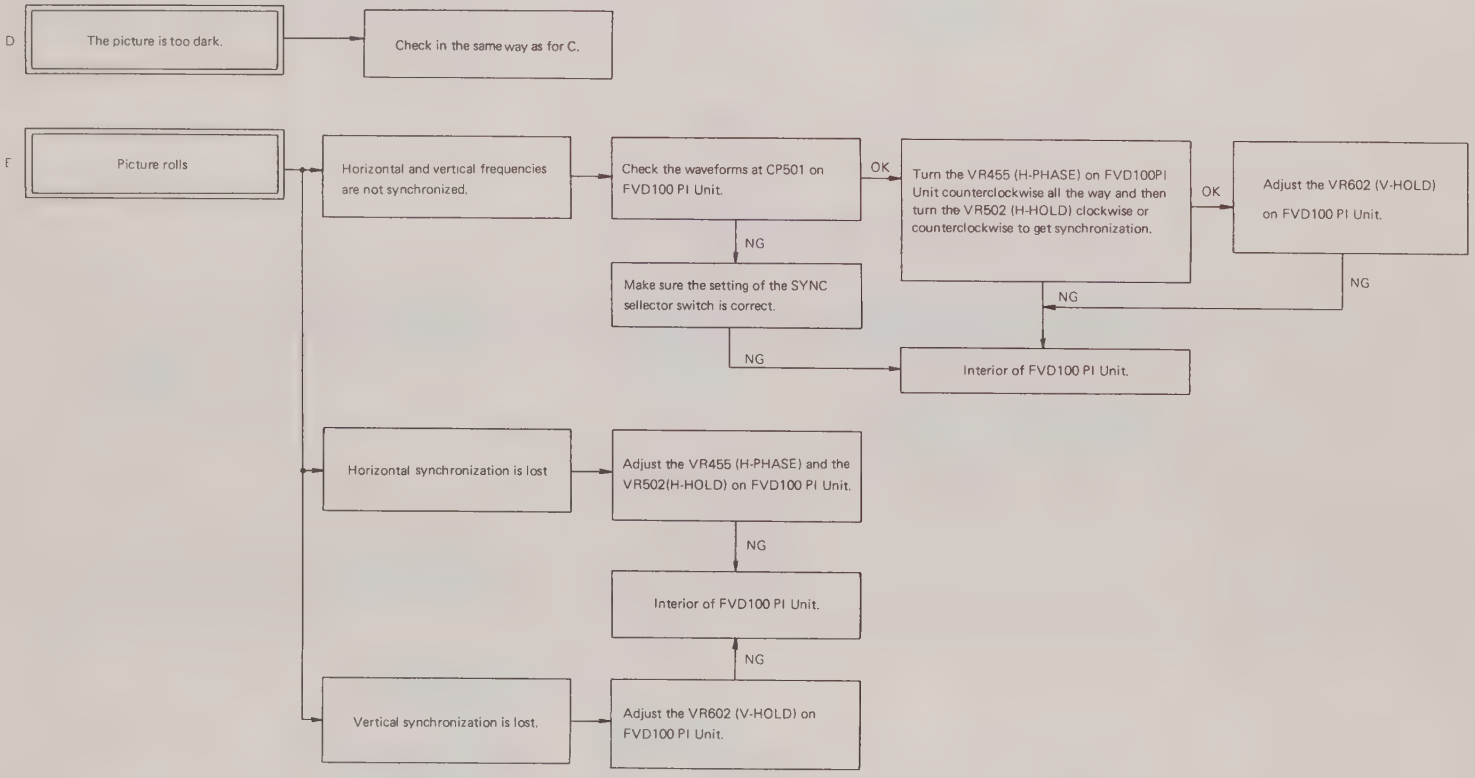
6.2 CORRECTIVE MAINTENANCE

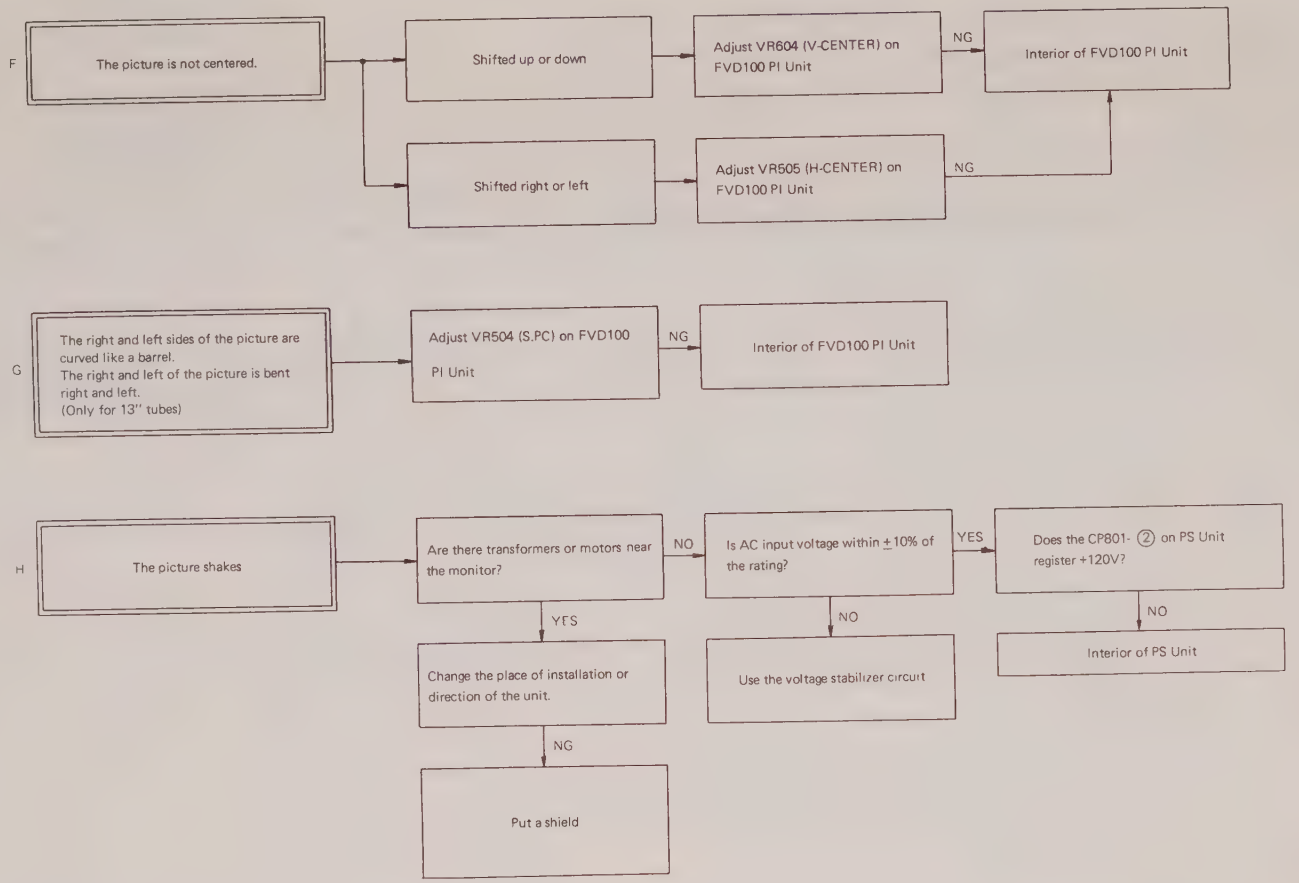
Corrective maintenance consists of the fault isolation as described in the following flow charts and Section 5 "ADJUSTMENT AND TEST".
When replacing the power supply unit, the printed circuit board and the component parts, it may be necessarry to refer to Section 5 "ADJUSTMENT AND TEST".
The fault isolation includes:

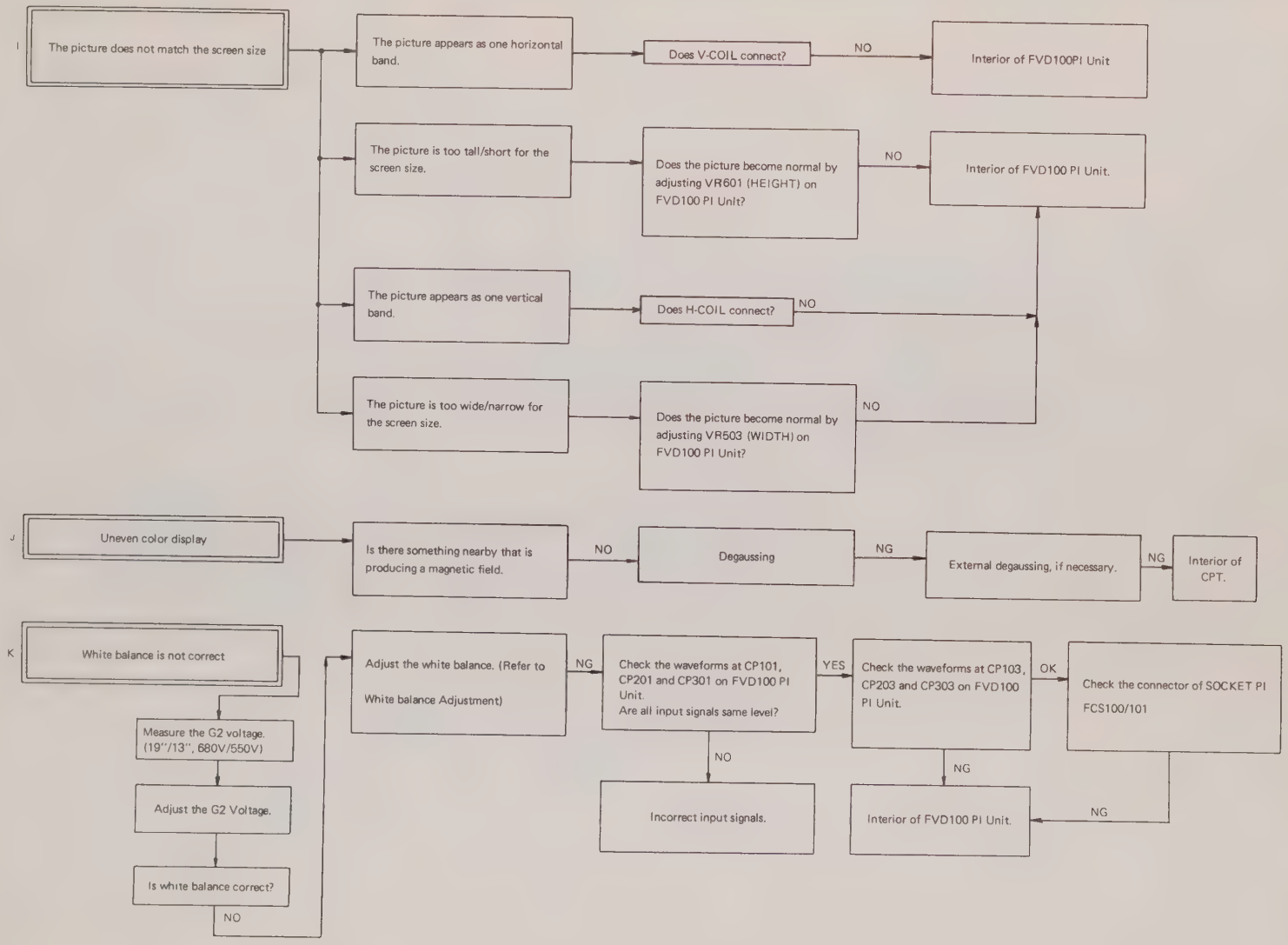
A. Raster doesn't appear.
B. Picture doesn't appear.
C. Picture is too bright.
D. Picture is too dark.
E. Picture rolls.
F. Picture is not centered.
G. Left and right sides of the picture are curved.
H. Picture shakes.
I. Picture does not match the screen size.
J. Picture color is uneven.
K. White balance is incorrect.


A
The raster doesn't appear
Are the SW101, 201, 301 ON? (Beam switches)
Check the connectors CH801, 802, 803, 804 (PS Unit)
Check the Power switch
NO
Make sure power is ON.
OK
Is the fuse blown?
NO
YES
Find the caused and replace the fuse.
Is the correct fuse used?
YES
3
Does the heater of the CPT. light?
YES
1
NO
Does the CP801-⑤ on PS unit register +6.3V?
YES
Check the connection between PS Unit and CPT SOCKET
OK
Check the parts on FCS 100/101 and the connection between CPT SOCKET and CPT
OK
Snapping of a CPT heater
NO
Interior of PS Unit.
1
Does the CP801-② on PS Unit register 120V?
YES
NO
Interior of PS Unit.
Does the CP801-④ on PS Unit register +24V ± 10%?
YES
NO
Interior of PS Unit.
Check the waveforms at CP101, CP201 and CP301 on FVD100 PI Unit.
OK
NG
Check the connector on FVD100 PI Unit.
NG
Interior of Input Signal.
Check the waveforms at CP103, CP203 and CP303 on FVD100 PI Unit
OK
NG
Adjust the RED GAIN, GREEN GAIN and BLUE GAIN of FVD100 PI Unit. Does the raster appear?
NO
Interior of FVD100 PI Unit.
Check the connecting between FVD100 PI Unit and CPT SOCKET (R-OUT, G-OUT, B-OUT to R, G, B)
OK
2
2
Check the connecting between CPT SOCKET and CRT.
OK
Measure the G2 Voltage. (19"/13", 680V/550V)
OK
NG
Measure the anode voltage. (19"/13", 27.5kV/23.0kV)
OK
NG
Interior of the CPT.
Interior of PS Unit
3
Check the connectors of VIDEO H-COIL, V-COIL PSCONT, DCPS
CPT R, G, B, H, GD VG1, VG2
NG
Correction
OK
OK
Pull out the PS Unit connectors CN803 and CN804, change the fuse, and make power SW on.
Are the CP801-②, ④ and ⑤ on PS Unit + 6.3V, + 24V and +120V?
OK
NG
Interior of PS Unit
Connect the connector CN803 on PS Unit. Is the fuse blown?
YES
NO
Interior of FVD100 PI Unit
Connect the connector CN 804 on PS Unit. Is the fuse blown?
YES
NO
Interior of CPT
If this fuse is blown many times, Change the all Unite.


B
The picture doesn't appear.
Check the waveforms at CP101, CP201 and CP301 on FVD100 PI Unit.
OK
Check the waveforms at CP103, CP203 and CP303 at FVD100 PI Unit.
OK
Check the connector cord between FVD100 PI Unit and the CPT
NG
NG
Check the connectors on FVD100 PI Unit.
Adjust the RED, GREEN, BLUE GAIN of FVD100 PI Unit. (VR104, 204, 304) Does the picture appear?
NO
Interior of FVD100PI Unit.
OK
Interior of Input signal.
Interior of PS Unit.
NG
C
The picture is too bright.
The picture does't appear because all colors are too bright.
Are +120V and +24V terminals on the PS Unit all right?
YES
Check the waveforms at CP103, CP203 and CP303 on FVD100PI Unit.
OK
Adjust the VG2 by turning VR901 on the SOCKET PI FCS100/101. (19"/13" 680V/550V)
NO
NG
Is picture good?
OK
NO
Interior of PS Unit.
Check the waveforms at CP101, CP201 and CP301 on FVD100 PI Unit.
OK
Interior of FVD100 PI Unit
NO
Check the connectors R-IN, G-IN, B-IN.
Incorrect input signals
NG
Is brightness control full turned?
NO
The picture appears, but it is too bright.
Check the waveforms at CP103, CP203 and CP303 on FVD100 PI Unit.
OK
Adjust the VG2 by turning VR901 on the SOCKET PI FCS100/101. (19"/13", 680V/550V)
OK
Is picture good?
NG
OK
Interior of FVD100 PI Unit.
NO
Check the waveforms at CP101, CP201 and CP301 on FVD100 PI Unit.
NG
Incorrect input signals
NG
The picture appears, but one color is too bright.
Check the waveforms at CP101(R), CP201(G) and CP301(B) on FVD100 PI Unit
OK
Check the waveforms at CP103(R), CP203(G) and CP303(B) on FVD100 PI Unit
OK
Check the connector of SOCKET PI FCS100/101.
NG
Incorrect input signals


D
The picture is too dark.
Check in the same way as for C.
F
Picture rolls
Horizontal and vertical frequencies are not synchronized.
Check the waveforms at CP501 on FVD100 PI Unit.
OK
Turn the VR455 (H-PHASE) on FVD100PI Unit counterclockwise all the way and then turn the VR502 (H-HOLD) clockwise or counterclockwise to get synchronization.
OK
Adjust the VR602 (V-HOLD) on FVD100 PI Unit.
NG
NG
Make sure the setting of the SYNC sellector switch is correct.
NG
Interior of FVD100 PI Unit.
Horizontal synchronization is lost
Adjust the VR455 (H-PHASE) and the VR502(H-HOLD) on FVD100 PI Unit.
NG
Interior of FVD100 PI Unit.
NG
Vertical synchronization is lost.
Adjust the VR602 (V-HOLD) on FVD100 PI Unit.


F
The picture is not centered.
Shifted up or down
Adjust VR604 (V-CENTER) on FVD100 PI Unit
NG
Interior of FVD100 PI Unit
Shifted right or left
Adjust VR505 (H-CENTER) on FVD100 PI Unit
NG
G
The right and left sides of the picture are curved like a barrel.
The right and left of the picture is bent right and left.
(Only for 13" tubes)
Adjust VR504 (S.PC) on FVD100 PI Unit
NG
Interior of FVD100 PI Unit
H
The picture shakes
Are there transformers or motors near the monitor?
NO
Is AC input voltage within ±10% of the rating?
YES
Does the CP801- ② on PS Unit register +120V?
NO
Interior of PS Unit
YES
Change the place of installation or direction of the unit.
NO
Use the voltage stabilizer circuit
NG
Put a shield


I
The picture does not match the screen size
The picture appears as one horizontal band.
Does V-COIL connect?
NO
Interior of FVD100PI Unit
The picture is too tall/short for the screen size.
Does the picture become normal by adjusting VR601 (HEIGHT) on FVD100 PI Unit?
NO
Interior of FVD100 PI Unit.
The picture appears as one vertical band.
Does H-COIL connect?
NO
The picture is too wide/narrow for the screen size.
Does the picture become normal by adjusting VR503 (WIDTH) on FVD100 PI Unit?
NO
J
Uneven color display
Is there something nearby that is producing a magnetic field.
NO
Degaussing
NG
External degaussing, if necessary.
NG
Interior of CPT.
K
White balance is not correct
Measure the G2 voltage. (19''/13'', 680V/550V)
Adjust the G2 Voltage.
Is white balance correct?
NO
Adjust the white balance. (Refer to White balance Adjustment)
NG
Check the waveforms at CP101, CP201 and CP301 on FVD100 PI Unit. Are all input signals same level?
YES
NO
Incorrect input signals.
Check the waveforms at CP103, CP203 and CP303 on FVD100 PI Unit.
OK
NG
Interior of FVD100 PI Unit.
Check the connector of SOCKET PI FCS100/101
NG

APPENDIX I

RECOMMENDED SPARE PARTS

Hitachi Part No.	Description
100 – 000	19" standard phosphor color picture tube with yoke
100 – 001	19" long persistence phosphor color picture tube with yoke
100 – 010	13" standard phosphor color picture tube with yoke
100 – 011	13" long persistence phosphor color picture tube with yoke
100 – 100	19" standard phosphor color picture tube with yoke (Medium Resolution)
100 – 101	19" long persistence phosphor color picture tube with yoke (Medium Resolution)
100 – 110	13" standard phosphor color picture tube with yoke (Medium Resolution)
100 – 111	13" long persistence phosphor color picture tube with yoke (Medium Resolution)
200 – 001	Drawer Unit
300 – 001	Power Unit

APPENDIX II

RECOMMENDED CABLING

Good cabling practice is essential for displaying good pictures. Crosstalk and line reflections in the cable are easily handled if the high frequency characteristics and low impedance video signal generators are considered.

For each interface signal twisted pair or coaxial cable with characteristic impedance of close to 75 ohms should be used. (Higher impedances increase crosstalk while lower impedances are difficult to drive.)

The importance of good cabling desing is clearly seen from considering the following table of cable type versus distance. (These figures must be considered only approximate. For example, if high electrical noise levels are encountered coaxial cable could be mandatory at any distance.).

Connectors	Cable Type	Cabling Distance (Approximately)
AMP connector	Twisted pair, 0.4mm dia. wire with thin insulation twisted about 30 turns per foot or woven cable, 90 ohm impedance	35 – 50 feet (10 – 15m)
BNC connector	Coaxial cable with 75 ohm characteristic impedance	50 – 1,000 feet (15 – 300m)

APPENDIX III

PARTS LIST

1. GENERAL PARTS (For standard AMP connector)

CON001	Amp CONNECTOR, 1-480691-0	1
CN001	ACINLET, PA125	1
CN002, 802	CONNECTOR, LLP-06	2
	LLR-06	2
CN003, 803, 804	CONNECTOR, LLP-09	3
	LLR-09	3
CN801	CONNECTOR, LLP-04	1
	LLR-04	1
SW001	POWER SWITCH, S-6B CSA	1
SW002	SWITCH, 8N1021	1
SW003	SWITCH, 8A1011	1
F001	FUSE, 4A, 250V	1
	FUSE HOLDER, FH002	1
CP801	CHECK PIN, LLR-04	1
RP001	POSISTOR, 902P52E6R5YR4	1
DG001	DEGAUSS COIL, 61856 (19") or 61736 (13")	1
R001-4	RESISTOR, PLATE-OHM, 75ohm, 1/2W, ±5%	4
FOCUS	CONNECTOR, LP-01	1
	LR-01F	1
CPT	COLOR PICTURE TUBE	
	19" H6803 or 510VFB22TC01,	1
	[13" H6825 or 370FWB22TC02,]	[1]
	[13" 370JSB22TC02]	[1]

2. GENERAL PARTS (For optional BNC connectors with loopthrough)

CON001-8	COAXIAL CONNECTOR, UG-625/U	8
CN001	ACINLET, PA125	1
CN002, 802	CONNECTOR, LLP-06	2
	LLR-06	2
CN003, 803, 804	CONNECTOR, LLP-09	3
	LLR-09	3
CN801	CONNECTOR, LLP-04	1
	LLR-04	1
SW001	POWER SWITCH, S-6B CSA	1
SW002	SWITCH, 8N1021	1
SW003	SWITCH, 8A1011	1
SW004	SWITCH, 8A4011	1
F001	FUSE, 4A, 250V	1
	FUSE HOLDER, FH002	1
CP801	CHECK PIN, LLR-04	1
RP001	POSISTOR, 902P52E6R5YR4	1
DG001	DEGAUSS COIL, 61856 (19") or 61736 (13")	1
R001-4	RESISTOR, PLATE-OHM, 75ohm, 1/2W, ±5%	4
FOCUS	CONNECTOR, LP-01	1
	LR-01F	1
CPT	COLOR PICTURE TUBE	
	19" H6803 or 510VFB22TC01,	1
	[13" H6825 or 370FWB22TC02,]	[1]
	[13" 370JSB22TC02]	[1]

3. GENERAL PARTS (For optional BNC connectors with loopthrough and Channel A/Test select)

CON001-9	COAXIAL CONNECTOR, UG-625/U	9
CN001	ACINLET, PA125	1
CN002, 802	CONNECTOR, LLP-06	2
	LLR-06	2
CN003, 803, 804	CONNECTOR, LLP-09	3
	LLR-09	3
CN801	CONNECTOR, LLP-04	1
	LLR-04	1
SW001	POWER SWITCH, S-6B CSA	1
SW002	SWITCH, 8N1021	1
SW003	SWITCH, 8A1011	1
SW004, SW005	SWITCH, 8A4011	2
F001	FUSE, 4A, 250V	1
	FUSE HOLDER, FH002	1
CP801	CHECK PIN, LLR-04	1
RP001	POSISTOR, 902P52E6R5YR4	1
DG001	DEGAUSS COIL, 61856 (19") or 61736 (13")	1
R001-4	RESISTOR, PLATE-OHM, 75ohm, 1/2W, ±5%	4
FOCUS	CONNECTOR, LP-01	1
	LR-01F	1
CPT	COLOR PICTURE TUBE	1
	19" H6803 or 510VFB22TC01,	[1]
	[13" H6825 or 370FWB22TC02,]	[1]
	[13" 370JSB22TC02]	

Q101, 104, 201, 204, 301, 304	TRANSISTOR, 2SC2547	6
Q102, 202, 302	TRANSISTOR, 2SC1747	3
Q103, 106, 203, 206, 303, 306	TRANSISTOR, 2SA711	6
Q105, 205, 305 460, 503	TRANSISTOR, 2SC1833	5
Q107, 207, 307 501, 502	TRANSISTOR, 2SC1505	5
Q108, 208, 308	TRANSISTOR, 2SC32	3
Q109, 209, 309, 451, 452, 454, 455, 457, 458, 459	TRANSISTOR, 2SA530	10
Q402, 403	TRANSISTOR, 2SC479	2
Q453, 456	TRANSISTOR, 2SC321	2
D451-5(502)	DIODE, A-35	5(6)
D503-6, 601, 401	DIODE, V09G	6
ZD101, 201, 301	SENER DIODE, HZ-16	3
ZD401	ZENER DIODE, HZ-6	1
ZD451	ZENER DIODE, AW01-12	1
ZD501	ZENER DIODE, HZ-7L	1
ZD102, 202, 302 502, 601	ZENER DIODE, HZ-12	5
R119, 122, 219, 222 319, 322	RESISTOR, PLATE-OHM, 100ohm, 1/4W, ±5%	6
R463, 531, 529	RESISTOR, PLATE-OHM, 1Kohm, 1/4W, ±5%	3
R120, 220, 320	RESISTOR, PLATE-OHM, 2Kohm, 1/4W, ±5%	3
R117, 217, 317	RESISTOR, PLATE-OHM, 30ohm, 1/4W, ±5%	3
R118, 218, 318, 402	RESISTOR, PLATE-OHM, 51ohm, 1/4W, ±5%	4
R124, 224, 324	RESISTOR, PLATE-OHM, 75ohm, 1/4W, ±5%	3
R109-10, 112, 126 209-10, 212, 226 309-10, 312, 326 455, 131, 231, 331, 604	RESISTOR, PLATE-OHM, 100ohm, 1/4W, ±5%	17
R107, 207, 307, 513, 104, 204, 304	RESISTOR, PLATE-OHM, 200ohm, 1/4W, ±5%	7
R108, 113-4, 208 213-4, 308, 313-4 451, 460, 605, 458	RESISTOR, PLATE-OHM, 510ohm, 1/4W, ±5%	13
R111, 211, 311, 466, 515, 601	RESISTOR, PLATE-OHM, 680ohm, 1/4W, ±5%	6
R132, 232, 332, 407-8, 454	RESISTOR, PLATE-OHM, 1Kohm, 1/4W, ±5%	12

461, 483, 485, 514, 524-5,		
R127, 227, 327	RESISTOR, PLATE-OHM, 1.5Kohm, 1/4W, ±5%	3
R470, 472 476-7, 482, 510	RESISTOR, PLATE-OHM, 2Kohm, 1/4W, ±5%	6
R116, 128, 216, 228 316, 328, 490 602, 609	RESISTOR, PLATE-OHM, 2.2Kohm, 1/4W, ±5%	9
R486 R532	RESISTOR, PLATE-OHM, 3Kohm, 1/4W, ±5%	2
R420, 507, 520	RESISTOR, PLATE-OHM, 4.7Kohm, 1/4W, ±5%	3
R106, 206, 306, 480, 467 456, 462, 468, 473, 479, 489, 509, 488, 496	RESISTOR, PLATE-OHM, 5.1Kohm, 1/4W, ±5%	14
R503, 478 608	RESISTOR, PLATE-OHM, 6.8Kohm, 1/4W, ±5%	3
R523	RESISTOR, PLATE-OHM, 6.2Kohm, 1/4W, ±5%	1
R459, 471, 475, 487 481, 484, 611, 621 610, 603, 494	RESISTOR, PLATE-OHM, 10Kohm, 1/4W, ±5%	11
R105, 205, 305	RESISTOR, PLATE-OHM, 12Kohm, 1/4W, ±5%	3
R103, 203, 303	RESISTOR, PLATE-OHM, 20Kohm, 1/4W, ±5%	3
R452	RESISTOR, PLATE-OHM, 30Kohm, 1/4W, ±5%	1
R469, 492, 491	RESISTOR, PLATE-OHM, 51Kohm, 1/4W, ±5%	3
R474	RESISTOR, PLATE-OHM, 3.9Kohm, 1/4W, ±5%	1
R102, 202, 302, 508 528	RESISTOR, PLATE-OHM, 68Kohm, 1/4W, ±5%	5
R453, 457, 526-7	RESISTOR, PLATE-OHM, 100Kohm, 1/4W, ±5%	4
R133, 233, 333	RESISTOR, PLATE-OHM, 330ohm, 1/4W, ±5%	3
R464-5	RESISTOR, PLATE-OHM, 150ohm, 1/2W, ±5%	2
R406	RESISTOR, PLATE-OHM, 330ohm, 1/2W, ±5%	1
R607	RESISTOR, PLATE-OHM, 510ohm, 1/2W, ±5%	1
R511	RESISTOR, PLATE-OHM, 680ohm 1/2W, ±5%	1
R123, 223, 323, 522	RESISTOR, PLATE-OHM, 1Kohm, 1/2W, ±5%	4
R619	RESISTOR, PLATE-OHM, 1.5Kohm, 1/2W, ±5%	1
R521	RESISTOR, PLATE-OHM, 20Kohm, 1/2W, ±5%	1
R115, 215, 315, 401	RESISTOR, PLATE-OHM, 1Mohm, 1/2W, ±5%	4
C105, 205, 305	CAPACITOR, ELECTROLYTIC, 0.47μF, 50V, ±20%	3
C604	CAPACITOR, TANTALUM, 2.2μF, 35V, ±20%	1
C401, 403	CAPACITOR, ELECTROLYTIC, 10μF, 16V, ±20%	2
C108, 208, 308	CAPACITOR, ELECTROLYTIC, 1,000μF, 16V, ±20%	3
C101-2, 107, 201-2 207, 301-2, 307 451, 516-7	CAPACITOR, ELECTROLYTIC, 10μF, 25V, ±20%	12
C109-209, 309	CAPACITOR, ELECTROLYTIC, 33μF, 25V, ±20%	3

C453, 510	CAPACITOR, ELECTROLYTIC, 47μF, 25V, ±20%	2
C456, 529, 608	CAPACITOR, ELECTROLYTIC, 100μF, 25V, ±20%	3
C104, 112, 204, 212 304, 312, 457, 502	CAPACITOR, ELECTROLYTIC, 100μF, 35V, ±20%	8
C610	CAPACITOR, ELECTROLYTIC, 10μF, 35V, ±20%	1
C455, 605, 508	CAPACITOR, ELECTROLYTIC, 1μF, 50V, ±20%	3
C614	CAPACITOR, ELECTROLYTIC, 100μF, 160V, ±20%	1
C521, 522	CAPACITOR, ELECTROLYTIC, 4.7μF, 100V, ±20%	2
C611	CAPACITOR, ELECTROLYTIC, 10μF, 100V, ±20%	1
C609	CAPACITOR, ELECTROLYTIC, 4.7μF, 160V, ±20%	1
C118, 218, 318, 518	CAPACITOR, ELECTROLYTIC, 10μF, 160V, ±20%	4
C501, 530,	CAPACITOR, ELECTROLYTIC, 47μF, 160V, ±20%	2
C523	CAPACITOR, ELECTROLYTIC, 4.7μF, 250V, ±20%	1
C612	CAPACITOR, ELECTROLYTIC, 33μF, 250V, ±20%	1
C464, 465	CAPACITOR, CERAMIC, 51PF, 50V, ±5%	2
C459	CAPACITOR, CERAMIC, 100PF, 500V, ±10%	1
C603	CAPACITOR, CERAMIC, 150PF, 50V, ±10%	1
C103, 203, 303,	CAPACITOR, CERAMIC, 100PF, 500V, ±10%	3
C116-7, 216-7, 316-7, 461, 470	CAPACITOR, DIPPED MICA, 510PF, 300V, ±5%	8
C601-2	CAPACITOR, DIPPED MICA, 620PF, 300V, ±5%	2
C113, 213, 313	CAPACITOR, POLYESTER, 0.01μF, 50V, ±10%	3
C461	CAPACITOR, POLYESTER, 500PF, 50V, ±10%	1
C458	CAPACITOR, POLYESTER, 2200PF, 50V, +10%	1
C607, 463, 512	CAPACITOR, POLYESTER, 4700PF, 50V, ±10%	3
C507	CAPACITOR, POLYESTER, 6800PF, 50V, ±10%	1
C114, 214, 314, 469 460,	CAPACITOR, POLYESTER, 0.01μF, 50V, ±10%	5
C511	CAPACITOR, POLYESTER, 0.015μF, 50V, ±10%	1
C509	CAPACITOR, POLYESTER, 0.047μF, 50V, ±10%	1
C106, 206, 306, 452 454, 462	CAPACITOR, POLYESTER, 0.1μF, 50V, ±10%	6
C519	CAPACITOR, POLYESTER, 0.47μF, 250V, ±10%	1
C520	CAPACITOR, POLYESTER, 1μF, 250V, ±10%	1
C528	CAPACITOR, POLYESTER, 0.22μF, 200V, ±10%	1
C616	CAPACITOR, POLYESTER, 0.022μF, 200V, ±10%	1
C514	CAPACITOR, CERAMIC, 100PF, 500V, ±10%	1
C617	CAPACITOR, CERAMIC, 220PF, 500V, +10%	1
C513	CAPACITOR, CERAMIC, 1,000PF, 500V, ±10%	2
C524	CAPACITOR, CERAMIC, 470PF, 2KV, ±10%	1
C525	CAPACITOR, CERAMIC, 3,300PF, 2KV, ±10%	1
C527	CAPACITOR, OIL-FILLED, 1,500PF, 2KV, ±10%	1
C526	CAPACITOR, OIL-FILLED, 2,200PF, 2KV, ±10%	1
C466	CAPACITOR, OIL-FILLED, 0.002μF, 50V, ±10%	1

C467	CAPACITOR, POLYESTER, 1,500PF, 50V, ±10%	1
R129-30, 229 230, 329-30	RESISTOR, METAL OXIDE FILM, 2Kohm, 7W, ±5%	6
R530	RESISTOR, METAL OXIDE FILM, 4.7ohm, 1/2W, ±5%	1
R614	RESISTOR, METAL OXIDE FILM, 10ohm, 1W, ±5%	1
R405	RESISTOR, METAL OXIDE FILM, 680ohm, 1W, ±5%	1
R613	RESISTOR, METAL OXIDE FILM, 2.2Kohm, 1W, ±5%	1
R612	RESISTOR, METAL OXIDE FILM, 4.7Kohm, 1W, ±5%	1
R121, 221, 321	RESISTOR, METAL OXIDE FILM, 1Kohm, 1W, ±5%	3
R620	RESISTOR, METAL OXIDE FILM, 20ohm, 2W, ±5%	1
R615	RESISTOR, METAL OXIDE FILM, 100ohm, 2W, ±5%	1
R617	RESISTOR, METAL OXIDE FILM, 2.2Kohm, 2W, ±5%	1
R622	RESISTOR, METAL OXIDE FILM, 5.1Kohm, 2W, ±5%	1
R516	RESISTOR, METAL OXIDE FILM, 22Kohm, 2W, ±5%	1
R403	RESISTOR, METAL OXIDE FILM, 330ohm, 3W, ±5%	1
R517	RESISTOR, METAL OXIDE FILM, 2.2Kohm, 3W, +5%	1
VR505	VARIABLE RESISTOR, WR188KPVD, 100ohm	1
VR101, 201, 301, 504 601	VARIABLE RESISTOR, EVT-R4SA00B52, 500ohm,	5
VR104, 204, 304	VARIABLE RESISTOR, EVT-R4A00B13, 1Kohm	3
VR454	VARIABLE RESISTOR, EVT-R4SA00B33, 3Kohm	1
VR602	VARIABLE RESISTOR, EVT-R4SA00B53, 5Kohm	1
VR102, 202, 302 452-3, 502, 501, 503	VARIABLE RESISTOR, EVT-R4SA00B14, 10Kohm	8
CONTVR	VARIABLE RESISTOR, EWS-2WAF20B13, 1Kohm x4	2
VR603	VARIABLE RESISTOR, EVT-R4SA00B25, 200Kohm	1
VR604, 455	VARIABLE RESISTOR, EVM-H1GS00B54, 50Kohm	2
BRIGHTVR	VARIABLE RESISTOR, EWF-N2AF20B52, 500ohm x2	1
C111, 211, 311	CERAMIC TRIMMER, ECR-CA100H12, 100PF	3
L502	COIL, ELH-16F601	1
L501	COIL, HL2631C	1
L101, 201, 301	COIL, LT-K-2.7	3
L102, 202, 302	COIL, LT-K-5.6	3
TR501	TRANSFORMER, TR2009	1
TR502	TRANSFORMER, TR4003	1
SW101, 201, 301	SWITCH, 8A1013	3
CP101-3, 110-1, 201-3, 210-1, 301-3, 310-1, 451-5, 460, 501-3, 510-1, 601	CHECK PIN, #226	26
R1N1-3, G1N1-3, B1N1-3, DCPS1-3, ROUT, GOUT BOUT, BLKCTL, HCOIL1-3, VCOIL1-3 SYNCIN, POSONT1-3	CONNECTOR PIN, RT-02N-2.3A	26

IC501	INTEGRATED CIRCUIT, HA11235	1
IC451, 453-5	INTEGRATED CIRCUIT, MC14538BAL	4
IC452, 456	INTEGRATED CIRCUIT, MC14001	2
IC457	INTEGRATED CIRCUIT, MC14538BAL	1
(Q108, 208, 308, 402)	HEAT SINK, KOF, H309, L=20mm	4
(Q107, 207, 307)	HEAT SINK, T-220G, H321, L=30mm	3
Q504	TRANSISTOR, 2SD899	1
Q505	TRANSISTOR, 2SD692	1
Q601-2	TRANSISTOR, 2SD478	2
(Q504) (Q505)	TRANSISTOR SOCKET, S2-119B	2
L503	COIL, LT-L-4.7	1

5. P. C. B. MODEL FPS 100

IC702	INTEGRATED CIRCUIT, FS7824M	1
IC721	INTEGRATED CIRCUIT, μA723HC	1
IC841	INTEGRATED CIRCUIT, MC14049	1
Q703	TRANSISTOR, 2SC2613	1
Q704	TRANSISTOR, 2SA1009	1
Q705, 841	TRANSISTOR, 2SA673 Ⓐ K	2
Q721	TRANSISTOR, 2SC1446	1
Q722	TRANSISTOR, 2SA537AH	1
Q723	TRANSISTOR, 2SC1685	1
Q802, 821-3	TRANSISTOR, 2SD478	4
Q803	TRANSISTOR, 2SC2613	1
Q833-4	TRANSISTOR, 2SC1707AH	2
Q842-3, 805	TRANSISTOR, 2SC1833	3
D701-3	DIODE, S2VB40	3
D704, 721-2, 821-2, 806, 841-4	DIODE, A-35	10
D705	DIODE, 5CH4M	1
Q835	TRANSISTOR, 2SA530H	1
D706-7, 831	DIODE, V09G	3
D801, 803	DIODE, TD-15	2
D802, 805	DIODE, 1S1420	2
D804	DIODE, TD-15H	1
ZD721	ZENER DIODE, HZ-9	1
ZD801	ZENER DIODE, HZ-30	1
ZD831-2	ZENER DIODE, HZ-6L	2
ZD841	ZENER DIODE, HZ-12	1
R702, 811	RESISTOR, PLATE-OHM, 30ohm, 1/4W, ±5%	2
R739	RESISTOR, PLATE-OHM, 100ohm, 1/4W, ±5%	1
R703, 705	RESISTOR, PLATE-OHM, 150ohm, 1/4W, ±5%	2
R710	RESISTOR, PLATE-OHM, 1Kohm, 1/4W, ±5%	1
R728,*735, 812, 844	RESISTOR, PLATE-OHM, 510ohm, 1/4W, ±5%	4
R709	RESISTOR, PLATE-OHM, 10ohm, 1/4W, ±5%	1
R729-32,*736, 740 801, 805, 841, 848	RESISTOR, PLATE-OHM, 1Kohm, 1/4W, ±5%	10
R846-7	RESISTOR, PLATE-OHM, 2Kohm, 1/4W, ±5%	2
*R738, 733-5, 849	RESISTOR, PLATE-OHM, 5.1Kohm, 1/4W, ±5%	5
R723	RESISTOR, PLATE-OHM, 5.6Kohm, 1/4W, ±5%	1
R722	RESISTOR, PLATE-OHM, 3Kohm, 1/4W, ±5%	1
R726-7, 737, 825	RESISTOR, PLATE-OHM, 10Kohm, 1/4W, ±5%	3
R724	RESISTOR, PLATE-OHM, 24Kohm, 1/4W, ±5%	1

R813	RESISTOR, WIRE WOUND, 2.0ohm, 2W, ± 10%	1
R721, 826-7, 839 711, 829	RESISTOR, PLATE-OHM, 100Kohm, 1/4W, ±5%	6
R842	RESISTOR, PLATE-OHM, 200Kohm, 1/4W, ±5%	1
R823	RESISTOR, PLATE-OHM, 15Kohm, 1/4W, ±5%	2
R802	RESISTOR, PLATE-OHM, 56Kohm, 1/4W, ±5%	1
R821-2	RESISTOR, PLATE-OHM, 30Kohm, 1/2W, ±5%	2
R832, 840	RESISTOR, PLATE-OHM, 750Kohm, 1/2W, ±5%	2
R809	RESISTOR, PLATE-OHM, 300Kohm, 1/2W, ±5%	1
R828	RESISTOR, PLATE-OHM, 330Kohm, 1/2W, ±5%	1
R837, 824	RESISTOR, PLATE-OHM, 510Kohm, 1/2W, ±5%	2
R836, 838, 843	RESISTOR, PLATE-OHM, 1Mohm, 1/2W, ±5%	3
R835	RESISTOR, PLATE-OHM, 47Kohm, 1/2W, ±5%	1
R814	RESISTOR, PLATE-OHM, 10Kohm, 1/2W, ±5%	1
C725	CAPACITOR, ELECTROLYTIC, 10μF, 16V, ±20%	1
C702	CAPACITOR, ELECTROLYTIC, 100μF, 16V, ±20%	1
C701	CPAPCITOR, ELECTROLYTIC, 2,200μF, 16V, ±20%	1
C704	CAPACITOR, ELECTROLYTIC, 100μF, 35V, ±20%	1
C703	CAPACITOR, ELECTROLYTIC, 1,000μF, 50V, ±20%	1
C843	CAPACITOR, ELECTROLYTIC, 2.2μF, 50V, ±20%	1
C842	CAPACITOR, ELECTROLYTIC, 10μF, 25V, ±20%	1
C810	CAPACITOR, POLYESTER, 0.47μF, 250V, ±10%	1
C804	CAPACITOR, POLYESTER , 4.7μF, 250V, ±20%	1
C707	CAPACITOR, ELECTROLYTIC, 10μF, 160V, ±20%	1
C802	CAPACITOR, ELECTROLYTIC, 100μF, 160V, ±20%	1
C833	CAPACITOR, ELECTROLYTIC, 4.7μF, 250V, ±20%	1
C705	CAPACITOR, ELECTROLYTIC, 470μF, 250V, ±20%	1
C721	CAPACITOR, POLYESTER, 2,200PF, 50V, ±10%	1
C724, 726-7, 841	CAPACITOR, POLYESTER, 0.047μF, 50V, ±10%	4
C821	CAPACITOR, POLYESTER, 2,200PF, 100V, ±10%	1
C801, 803, 809	CAPACITOR, POLYESTER, 0.1μF, 200V, ±10%	3
C805	CAPACITOR, CETAMIC, 1,000PF, 500V, ±10%	1
C832	CAPACITOR, CERAMIC, 390PF, 2KV, ±10%	1
C812	CAPACITOR, CERAMIC, 750PF, 15KV, ±20%	1
C806-7	CAPACITOR, OIL-FILLED, 2,200PF, 2KV, ±10%	2
C808	CAPACITOR, OIL-FILLED, 0.047μF, 2KV, ±10%	1
C723	CAPACITOR, ELECTROLYTIC, 10μF, 25V, ±20%	1
R807-8	BESISTOR, METAL OXIDE FILM, 1Mohm, 1W, ±5%	2
R806	RESISTOR, METAL OXIDE FILM, 47Kohm, 2W, ±5%	1
R804	RESISTOR, METAL OXIDE FILM, 2.2Kohm, 3W, ±5%	1
R704, 706	RESISTOR, METAL OXIDE FILM, 15Kohm, 3W, ±5%	2
R831	RESISTOR, METAL OXIDE FILM, 1ohm, 1/2W, ±5%	1
R708	RESISTOR, METAL OXIDE FILM, 0.75ohm, 2W, ±5%	1

R701	RESISTOR, METAL OXIDE FILM, 0.5ohm, 1W, ±5%	1
VR701	VARIABLE RESISTOR, EVT-J6US15B52, 500ohm,	1
VR721	VARIABLE RESISTOR, EVT-J6US15B53, 5Kohm	1
VR722	VARIABLE RESISTOR, EVT-J6US15B13, 1Kohm	1
*VR801	VARIABLE RESISTOR, EVM-J6U10KB25, 200Kohm	1
*VR831	VARIABLE RESISTOR, EVM-J6U10KB34, 30Kohm	1
RZ801	VARISTOR, ERZ-15D3K681	1
R707	RESISTOR, METAL OXIDE FILM, 39Kohm, 1W, ±5%	1
SGA1	VARISTOR, ZNR-391	1
TH721	THERMISTOR, ERT-D2F332S	2
L702-3	COIL, SN-10-50	1
L701	COIL, DP-91316	1
TR801	FLYBACK TRANSFORMER FS-51993	1
TR802	TRANSFORMER, TR-2009	1
TR803	TRANSFORMER, TR-3008	2
(Q703, 705)	HEAT SINK, 6030B	32
CN1-1-4, CN2-1-3, CN3-1-3, CN4-1-4, CN5-1-4, CN6-1-3, CN7-1-4, CN8-1-3, CN9-1-3, CN10-1	CONNECTOR PIN, RT-02N-2.3A	
IC701	INTEGRATED CIRCUIT, LM309M	1
Q702	TRANSISTOR, 2SB541	1
Q802	TRANSISTOR, 2SD748A	1
Q804	TRANSISTOR, 2SD350	1
TR701	TRANSFORMER, TR001	1
RD801	SILICON BLOCK, ECX-B1070G2	1
VR810	FOCUS BLOCK, DVM-P6GS23215	1
C811	CAPACITOR, CERAMIC, 750PF, 15kV, ±10%	1
(IC701) (Q702) (Q801) (Q804)	TRANSISTOR SOCKET, S2-119B-00	4
D807	D10DE, V06G	1

* All components shown are critical X-RAY safety related, replaces with exact part.

6. P. C. B. MODEL FCS100 (FOR 19INCH, 13INCH H6825, 370JSB22)

ZD901, 906, 911	ZENER DIODE, HZ-4	3
ZD902, 907, 912	ZENER DIODE, HZ-6L	3
ZD903, 908, 913	ZENER DIODE, HZ-9L	3
ZD904, 909, 914	ZENER DIODE, HZ-16L	3
ZD905, 910, 915	ZENER DIODE, HZ-20L	3
R901-3	RESISTOR, PLATE-OHM, 100ohm, 1/4W, ±5%	3
R904	RESISTOR, PLATE-OHM, 1Kohm, 1/4W, ±5%	1
R905	RESISTOR, PLATE-OHM, 100Kohm, 1/4W, ±5%	1
R906-911	RESISTOR, HIGH-MEGA 10Mohm, 1/2W, ±5%	6
C905	CAPACITOR, OIL FILLED, 2200PF, 2KV, ±10%	1
C901-4	CAPACITOR, POLYESTER, 0.1μF, 250V, ±10%	4
VR901	VARIABLE RESISTOR, EVT-J6US15B26, 2Mohm	1
S1	SOKET, SB0887	1
R, G, B, H, GD, VG1, VG2	CONNECTOR PIN, RT-02N-2.3A	7
CP901-7	CHECK PIN, KEL #226	7

P. C. B. MODEL – FCS101

7. P. C. M. MODEL FCS101 (FOR 13INCH 370FWB22)

ZD901, 906, 911	ZENER DIODE, HZ-4	3
ZD902, 907, 912	ZENER DIODE, HZ-6L	3
ZD903, 908, 913	ZENER DIODE, HZ-9L	3
ZD904, 909, 914	ZENER DIODE, HZ-16L	3
ZD905, 910, 915	ZENER DIODE, HZ-20L	3
R901-3	RESISTOR, PLATE-OHM, 100ohm, 1/4W, ±5%	3
R904	RESISTOR, PLATE-OHM, 1Kohm, 1/4W, ±5%	1
R905	RESISTOR, PLATE-OHM, 100Kohm, 1/4W, ±5%	1
R906-911	RESISTOR, HIGH-MECA, 10Mohm, 1/4W, ±5%	6
C905	CAPACITOR, OIL FILLED, 2200PF, 2KV, ±10%	1
C901-4	CAPACITOR, POLYESTER, 0.1μF, 250V, ±10%	4
VR901	VARIABLE RESISTOR, EVT-J6US15B26, 2M-ohm	1
S1	SOKET, HPS0079	1
R, G, B, H, GD, VG1, VG2	CONNECTOR PIN, RT-02N-2.3A	7
CP901-7	CHECK PIN, KEL #226	7

APPENDIX IV
EXPLODED VIEWS OF MECHANICAL PARTS

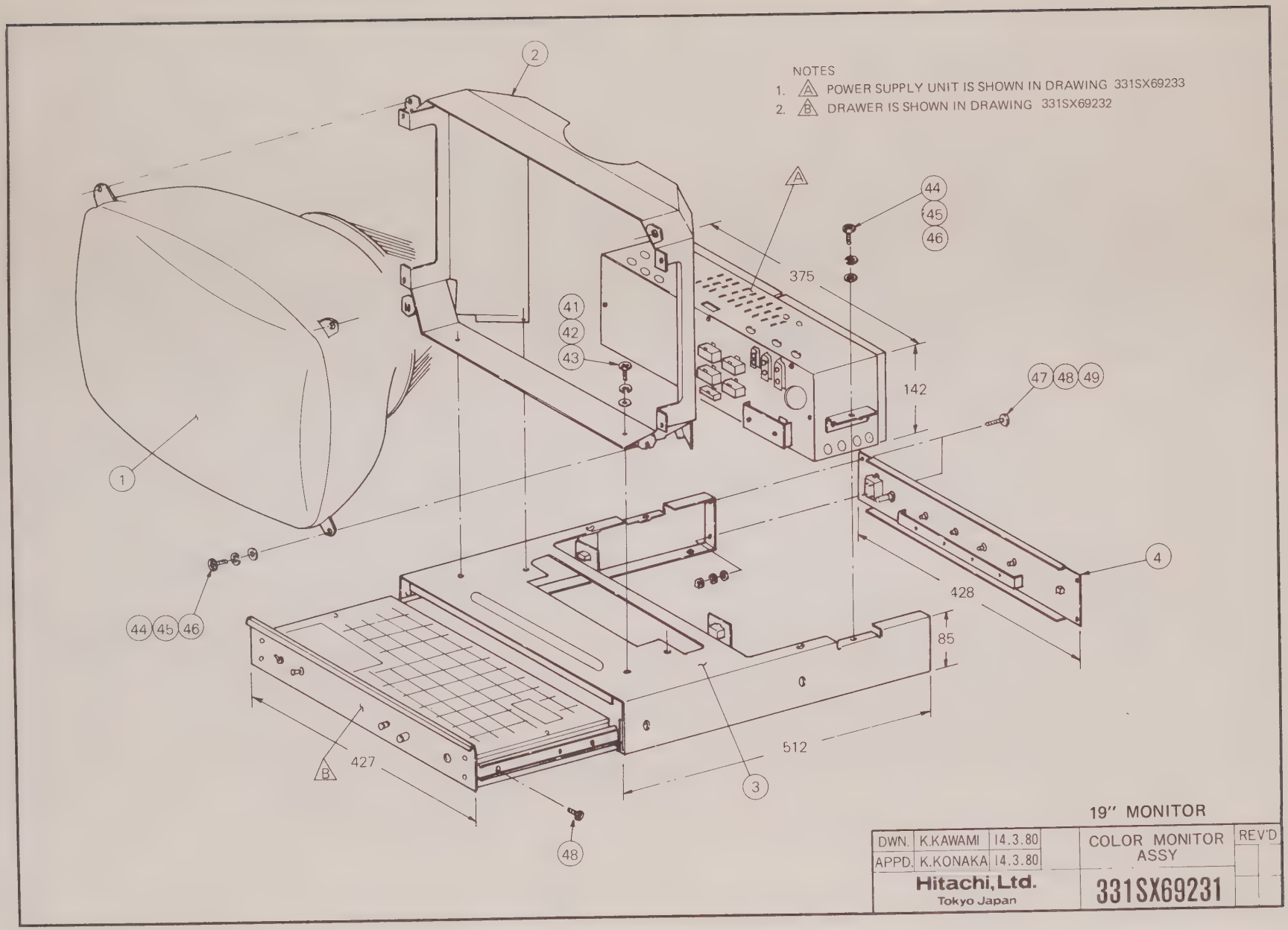
1. MECHANICAL PARTS LIST

ITEM NO.	REF. DESIGNATION	DESCRIPTION	
1	1	COLOR PICTURE TUBE	
2	2	FRAME	
3	3	BASE	
4	4	PANEL	
5	5	COVER	
6			
7			
8			
9			
10			
11	11	CHASSIS	
12	12	CHASSIS	
13	13	PRINTED CIRCUIT BOARD (FPS 100)	
14	14	BARRIER	
15	15	COVER	
16	16	BRACKET	
17	17	SUPPORT	
18	18	DIVIDER	
19	19	BRACKET	
20	20	SLIDE (ACCURIDE MODEL-203-12")	
21	21	HOLDER	
22	22	HOLDER	
23	23	PIN	
24	24	FIN	
25	25	FIN	
26			
27			
28			
29			
30			

ITEM NO.	REF. DESIGNATION	DESCRIPTION	
31			
32	32	COVER	
33	33	DRAWER	
34	34	PLATE	
35	35	KNOB	
36	36	KNOB	
37	37	LOCK	
38	38	DIVIDER	
39	39	PRINTED CIRCUIT BOARD (FVD 100)	
40			
41	41	PAN SCREW (M4×10)	
42	42	SPRING WASHER (M4)	
43	43	PLAIN WASHER (M4)	
44	44	PAN SCREW (M5×12)	
45	45	SPRING WASHER (M5)	
46	46	PLAIN WASHER (M5)	
47	47	FLAT HEAD SCREW (M4×16)	
48	48	PAN SCREW (M4×8)	
49	49	FINISHED NUT (M4)	
50	50	FLAT HEAD SCREW (M4)	
51	51	PAN SCREW (M3×8)	
52	52	SPRING WASHER (M3)	
53	53	PLAIN WASHER (M3)	
54	54	FLAT HEAD SCREW (M5)	
55	55	PAN SCREW (M3×6)	
56	56	FLAT HEAD SCREW (M3×10)	
57	57	FINISHED NUT (M3)	
58			
59			
60	60	RIVET (TAP-D-529)	

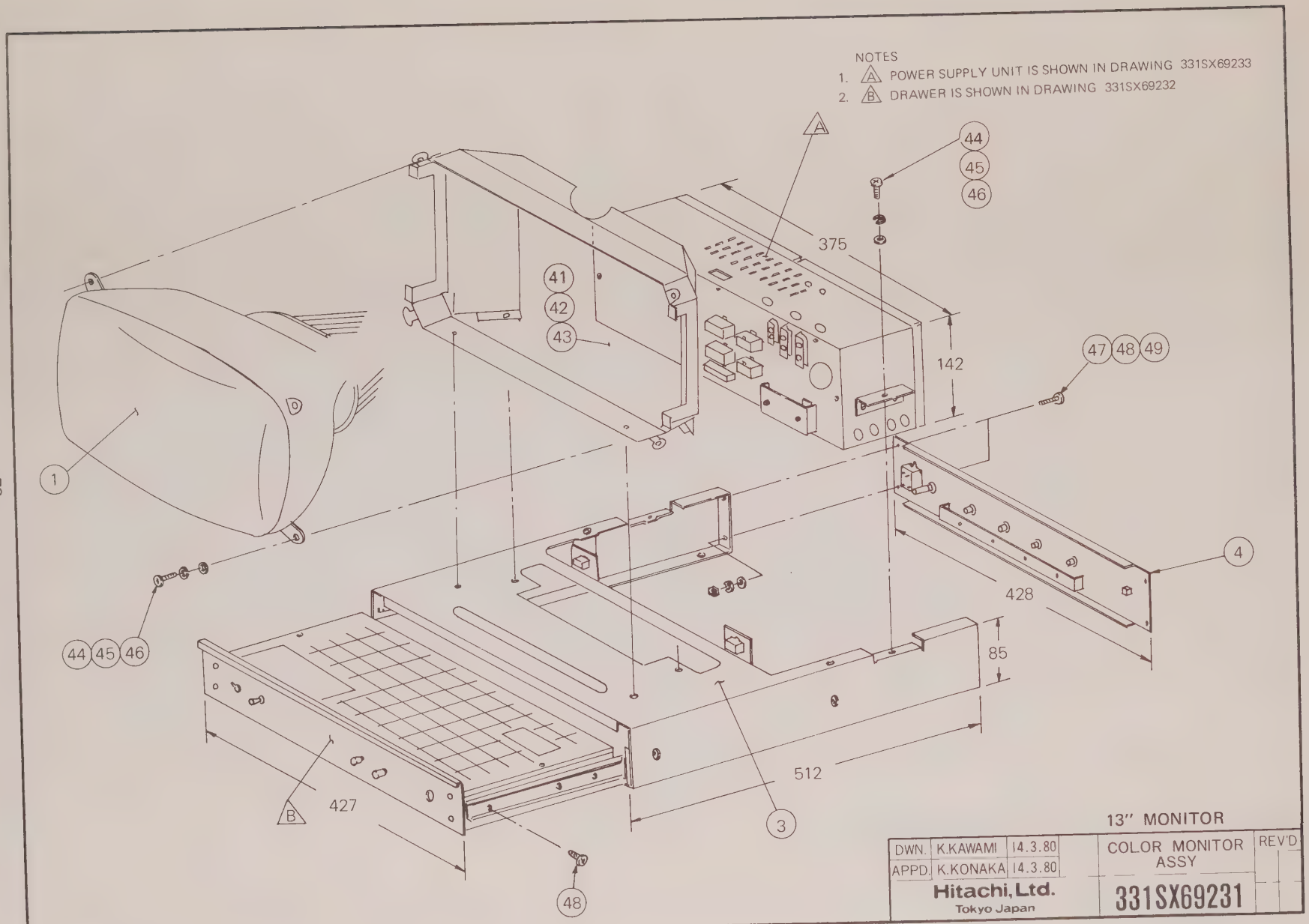
2. EXPLODED VIEWS OF MECHANICAL PARTS

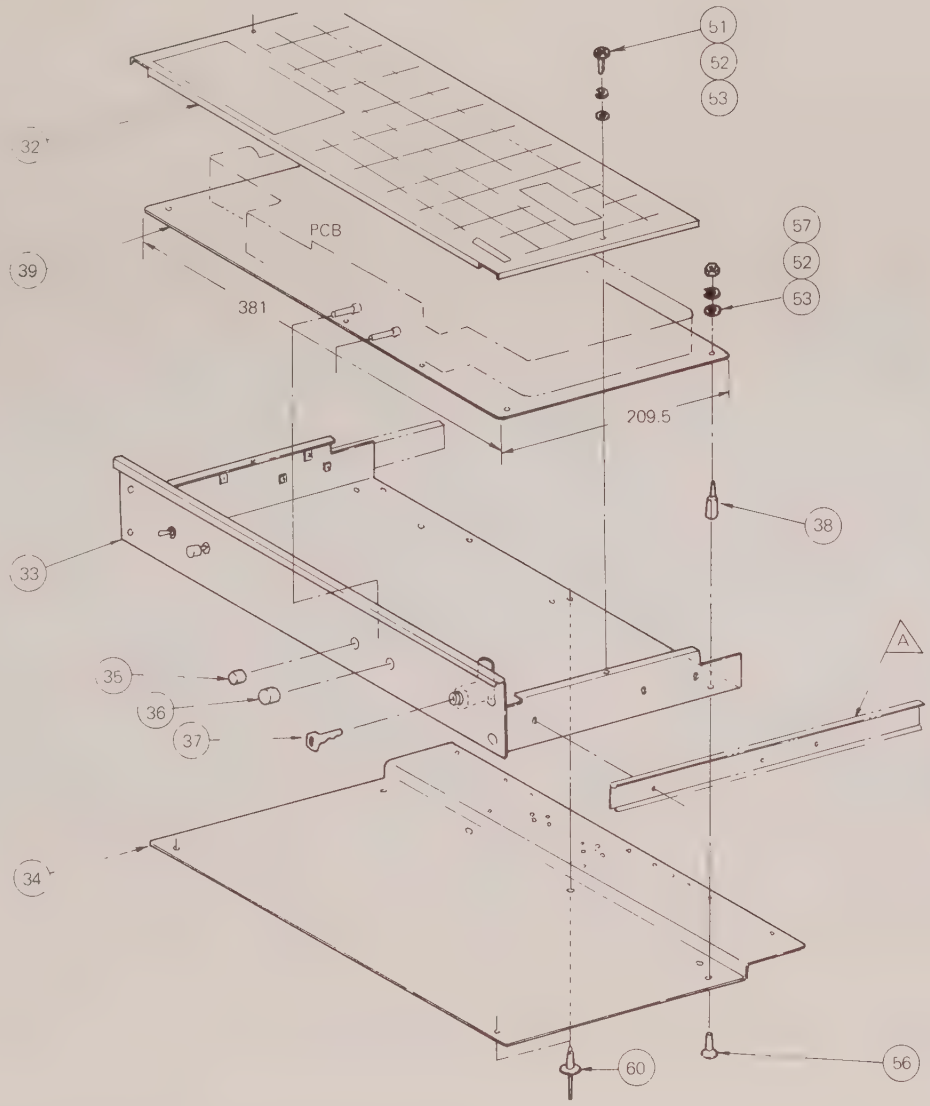
19"COLOR MONITOR ASSY	331SX69231A
13"COLOR MONITOR ASSY	331SX69231B
DRAWER ASSY	331SX69232
POWER SUPPLY ASSY	331SX69233
SLIDES ASSY	331SX69234



19" MONITOR

DWN.	K.KAWAMI	14.3.80	COLOR MONITOR ASSY	REV'D
APPD.	K.KONAKA	14.3.80		
Hitachi, Ltd. Tokyo Japan			331SX69231	

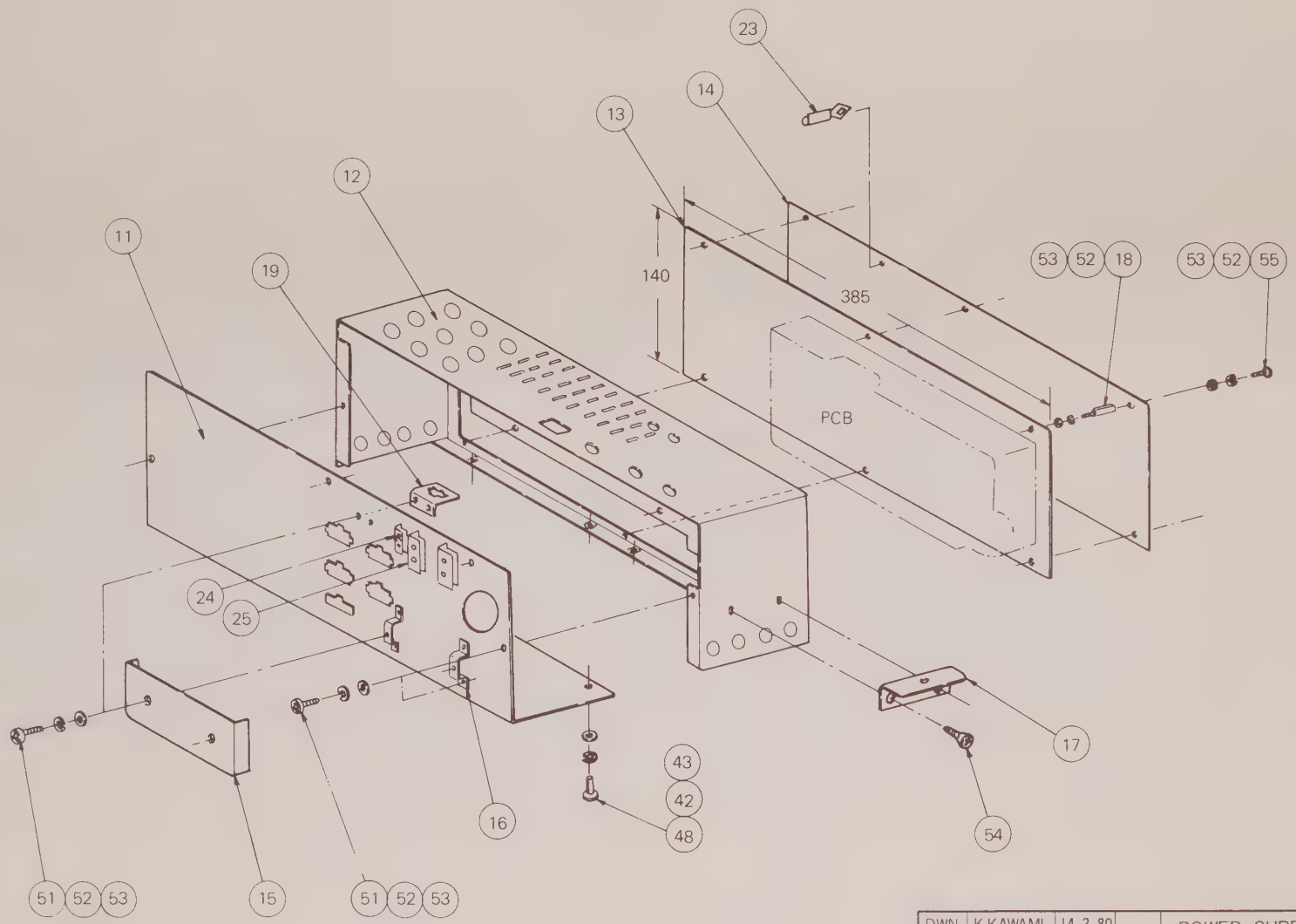

NOTES
1. A POWER SUPPLY UNIT IS SHOWN IN DRAWING 331SX69233
2. B DRAWER IS SHOWN IN DRAWING 331SX69232
A
44
45
46
375
41
42
43
142
47 48 49
1
4
428
44 45 46
85
B
427
512
3
48
13" MONITOR
DWN. K.KAWAMI 14.3.80
APPD. K.KONAKA 14.3.80
Hitachi, Ltd.
Tokyo Japan
COLOR MONITOR ASSY
331SX69231
REV'D



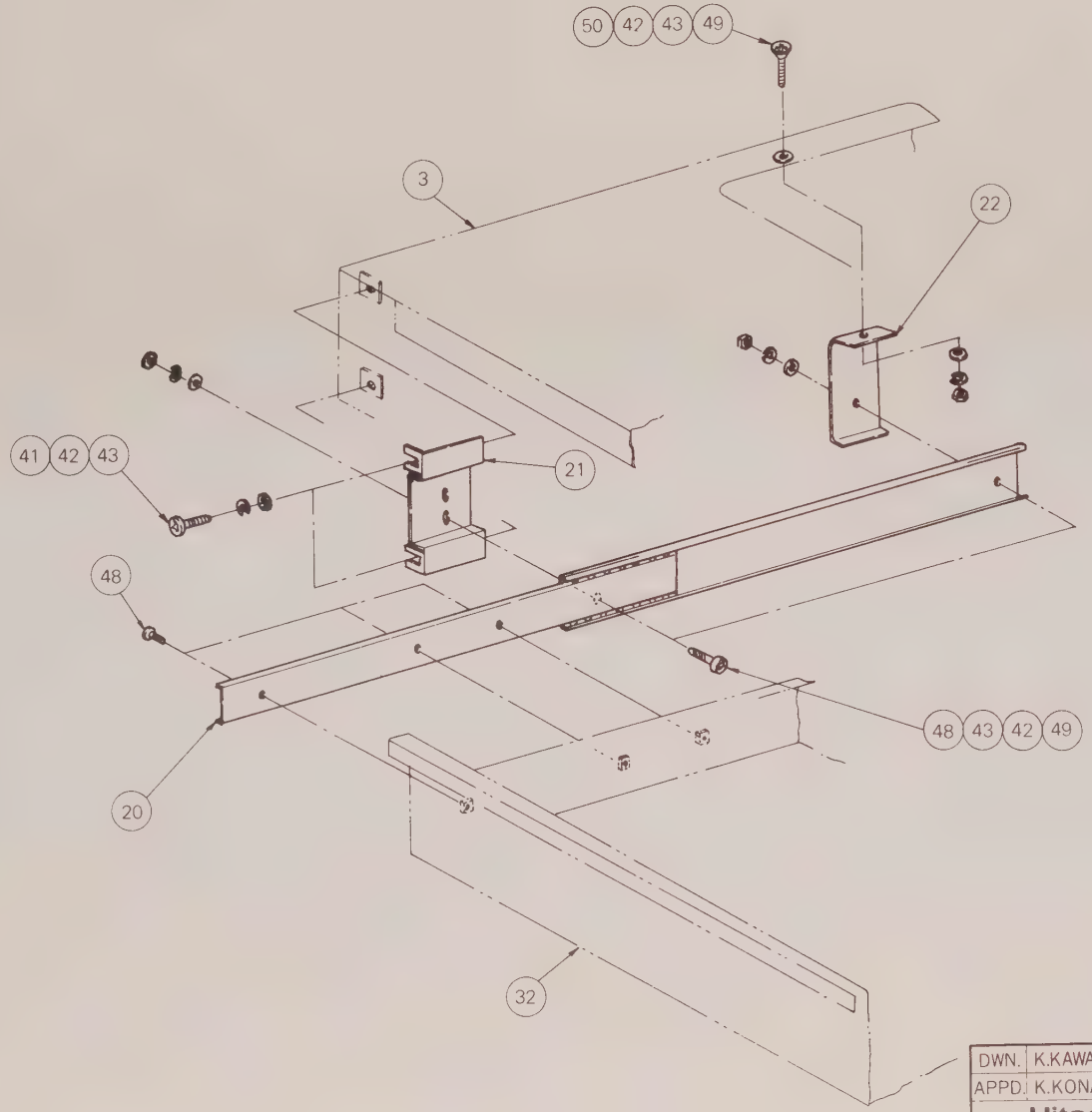
NOTES

A SLIDE IS SHOWN IN DRAWING 331SX69023

DWN.	K.KAWAMI	14.3.80	DRAWER ASSY	REV'D
APPD.	K.KONAKA	14.3.80		
Hitachi, Ltd. Tokyo Japan			331SX69232	



DWN.	K.KAWAMI	14.3.80	POWER SUPPLY ASSY	REV'D
APPD.	K.KONAKA	14.3.80		
Hitachi, Ltd. Tokyo Japan			331SX69233	

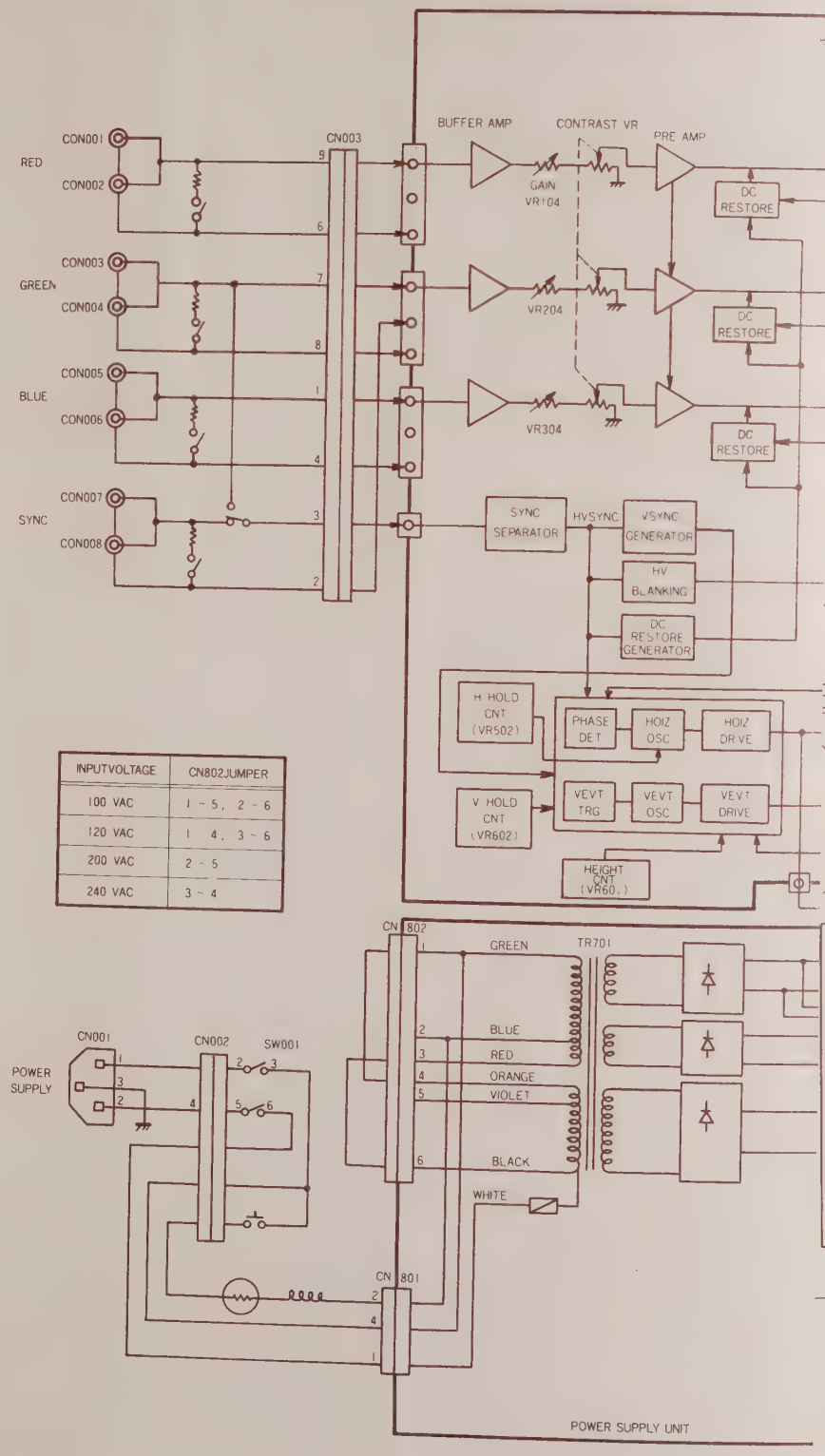


DWN.	K.KAWAMI	14.3.80	SLIDE ASSY	REV'D
APPD.	K.KONAKA	14.3.80		
Hitachi, Ltd. Tokyo Japan			331SX69234	

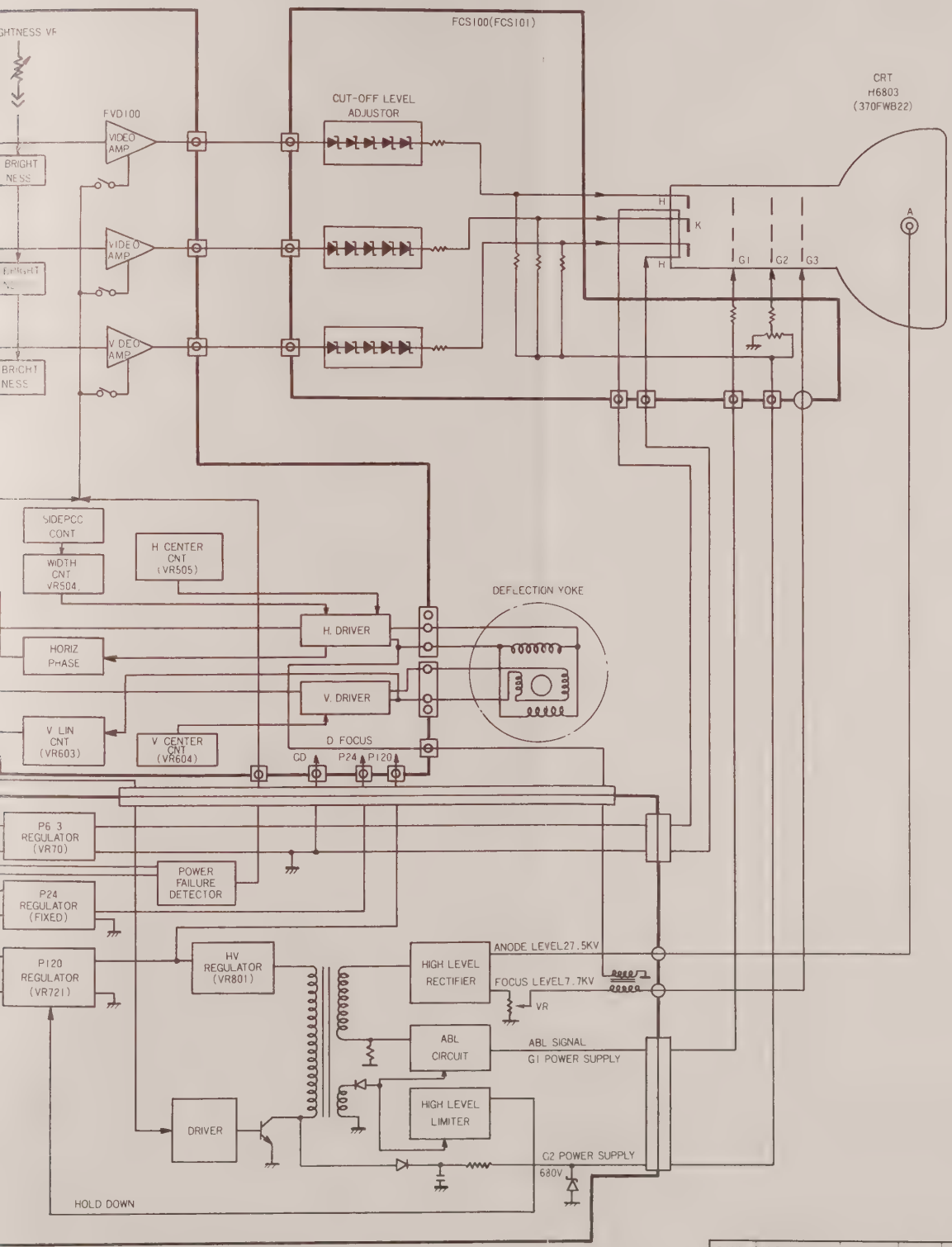
APPENDIX V

SCHEMATICS AND FUNCTIONAL DIAGRAMS

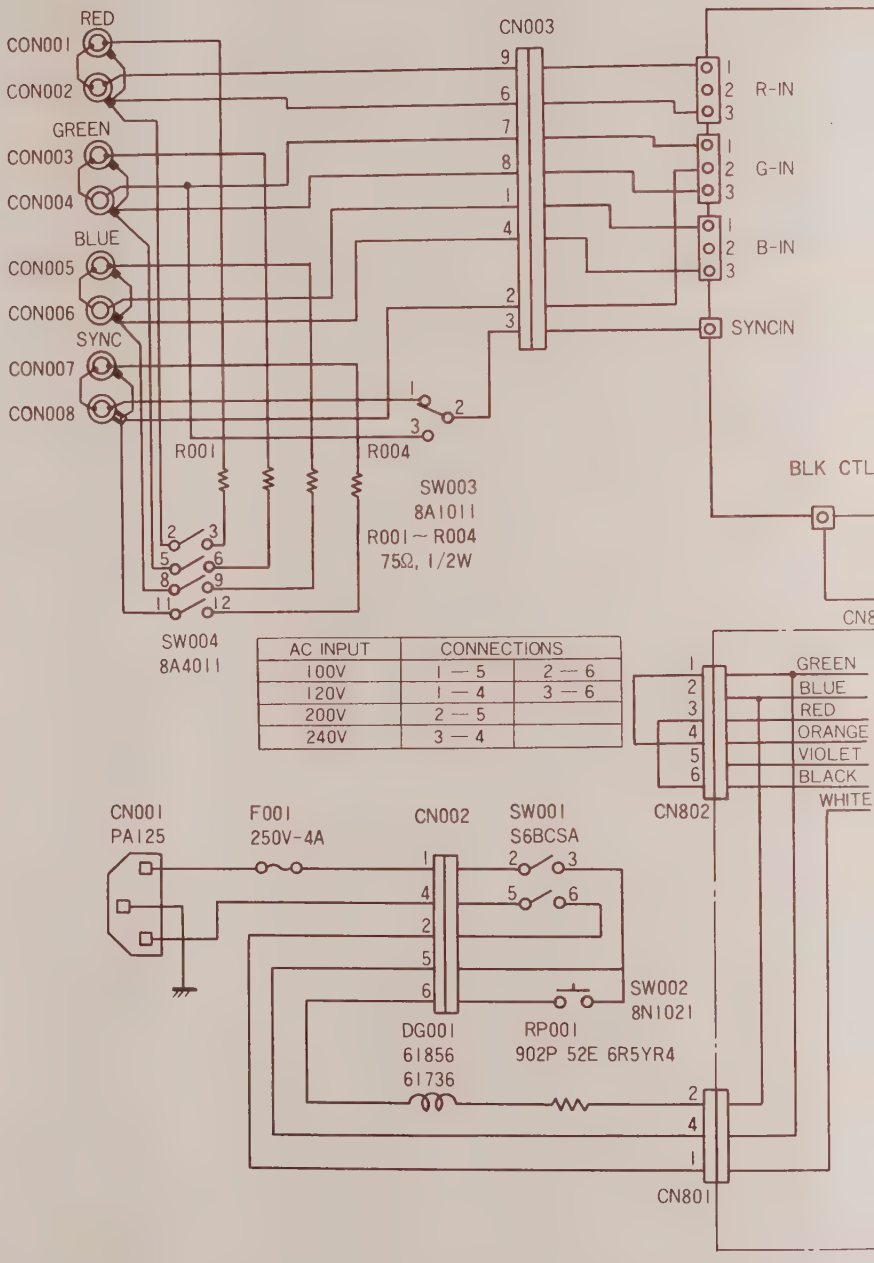
BLOCK DIAGRAM	331SX69235
WIRING DIAGRAM	331SX69236
LOGIC DIAGRAMS	
FVD 100 [A/3]	331SX69237
FVD 100 [B/3]	331SX69238
FVD 100 [C/3]	331SX69239
FPS 100 [A/3]	331SX69240
FPS 100 [B/3]	331SX69241
FPS 100 [C/3]	331SX69242
FCS 100 [FCS101]	331SX69243



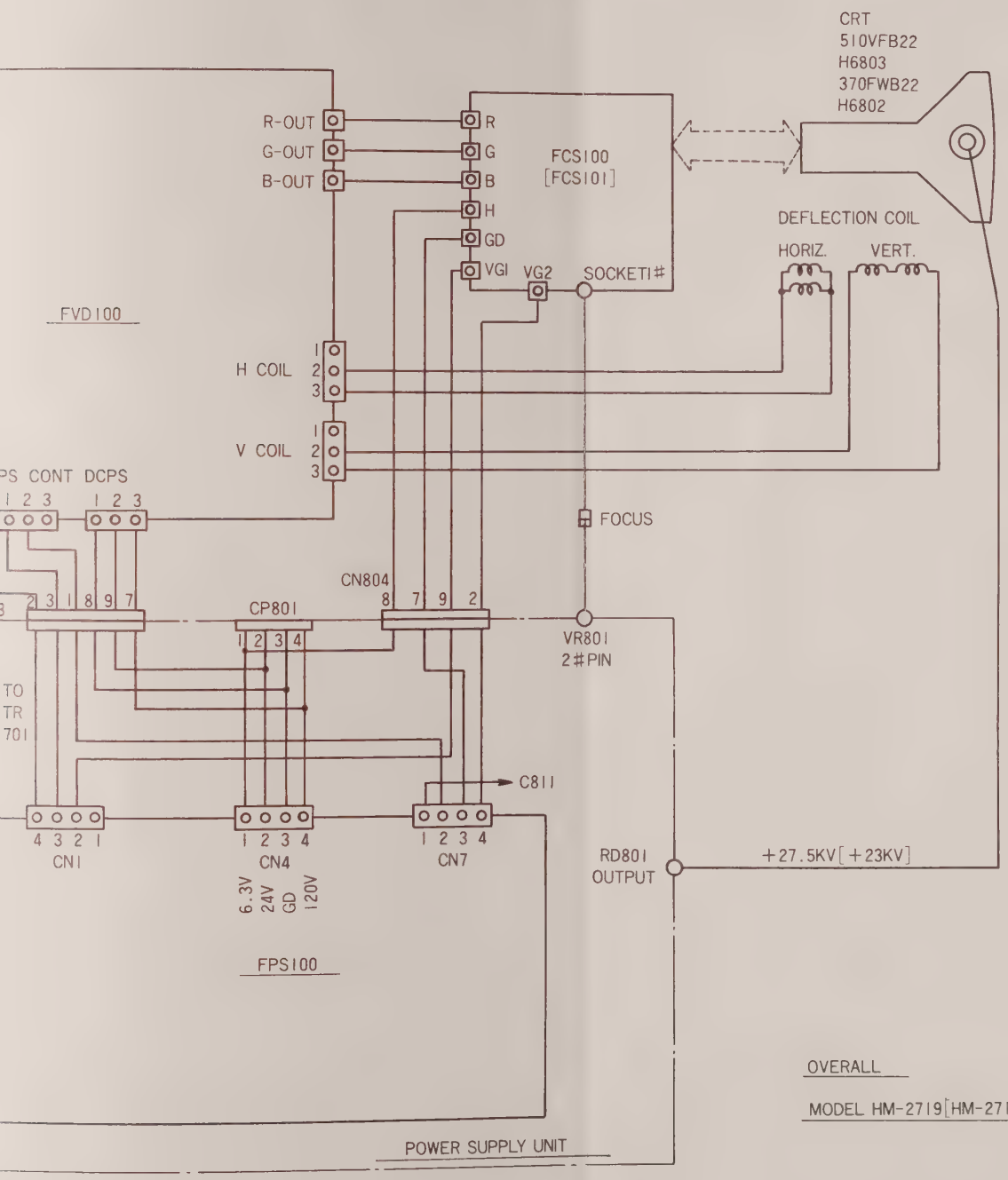
INPUTVOLTAGE	CN802JUMPER
100 VAC	1 ~ 5, 2 ~ 6
120 VAC	1 4, 3 ~ 6
200 VAC	2 ~ 5
240 VAC	3 ~ 4



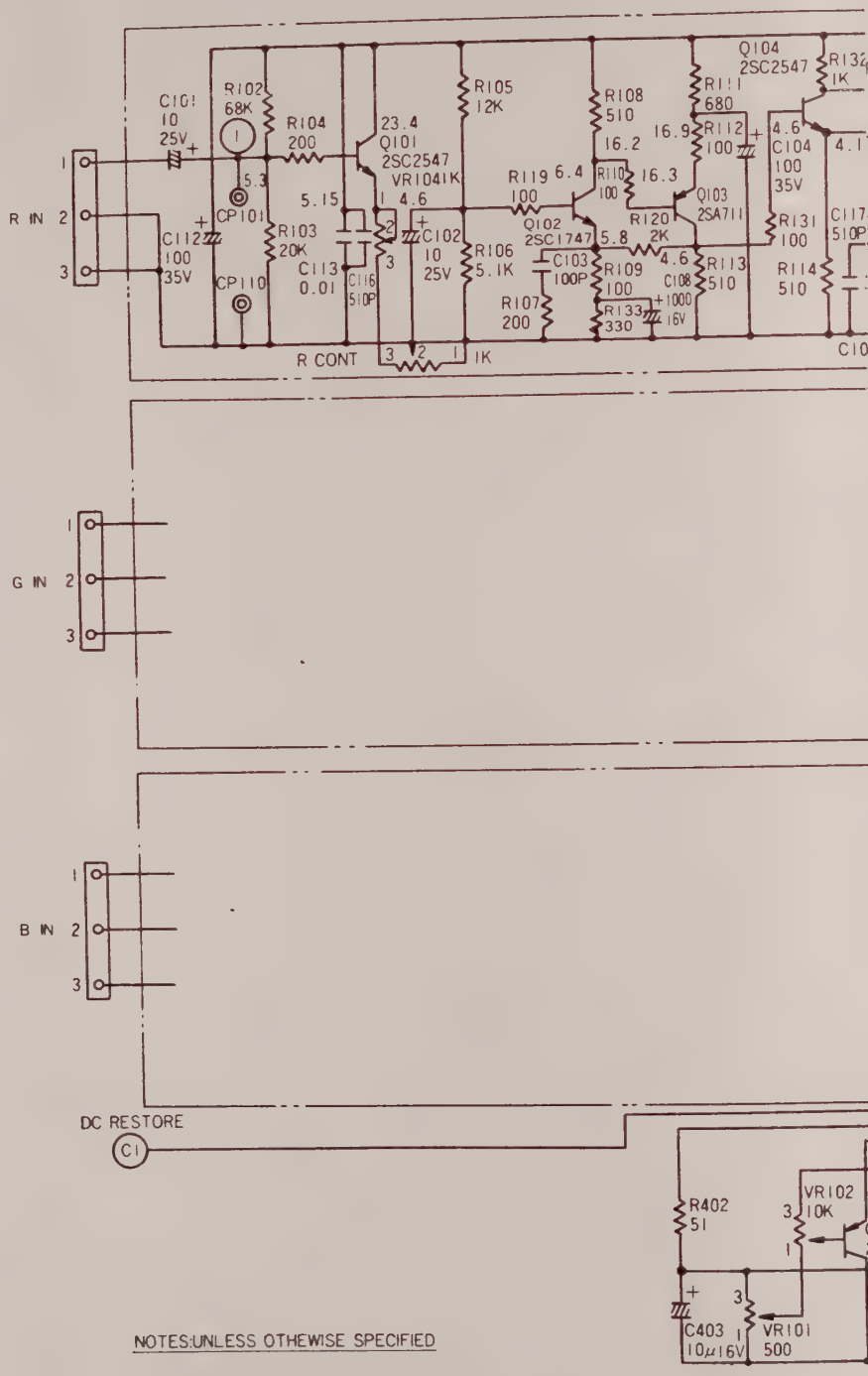
DWN.	K.SHIRAISHI	14.3.80	BLOCK DIAGRAM	REV'D
APPD.	K.KONAKA	14.3.80		
Hitachi, Ltd. Tokyo Japan			331SX69235	



AC INPUT	CONNECTIONS	
100V	1 — 5	2 — 6
120V	1 — 4	3 — 6
200V	2 — 5	
240V	3 — 4	



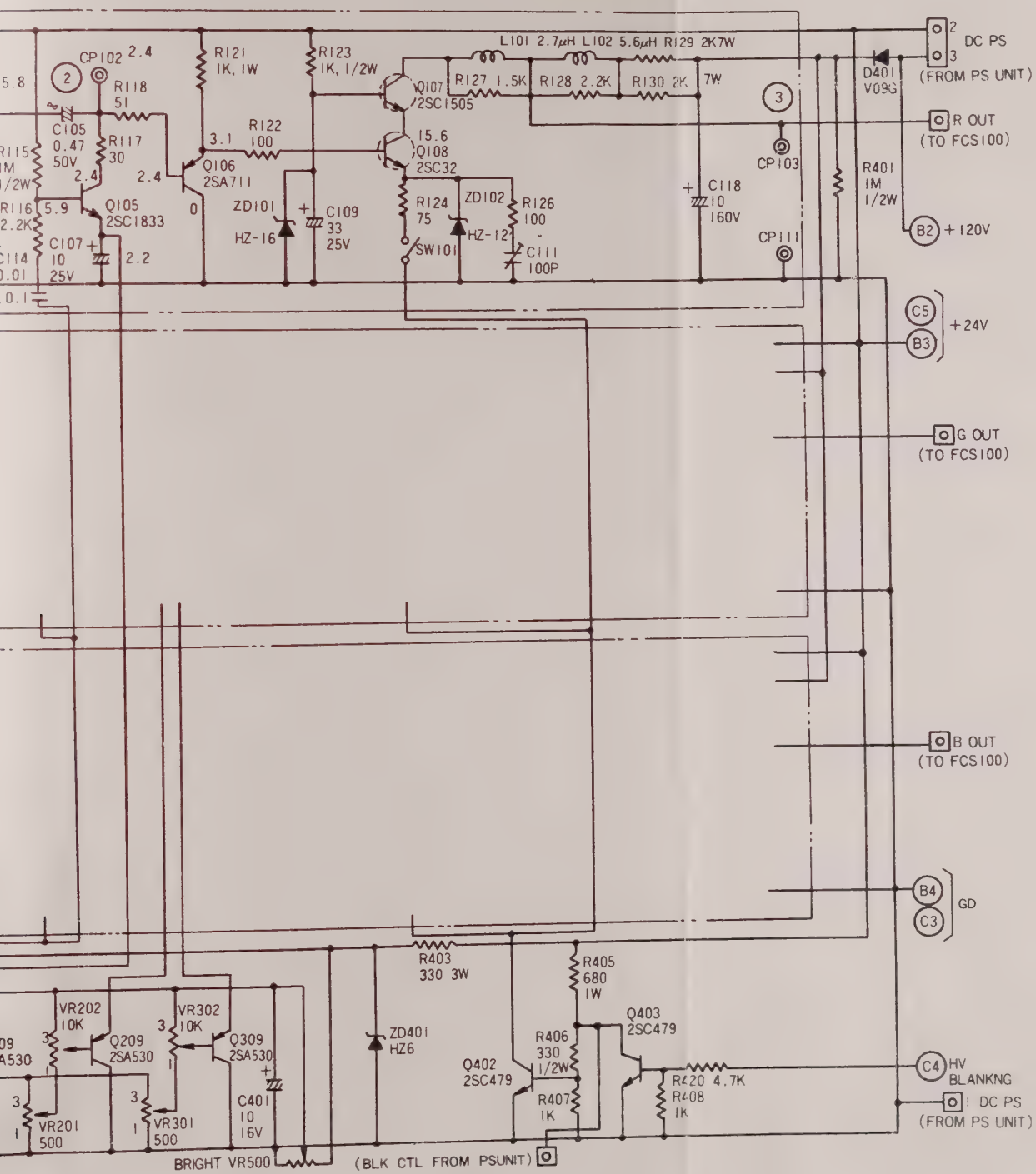
DWN.	K.SHIRAISHI	14.3.80	SCHEMATIC	REV'D
APPD.	K.KONAKA	14.3.80		
Hitachi, Ltd. Tokyo Japan			331SX69236	



NOTES:UNLESS OTHEWISE SPECIFIED

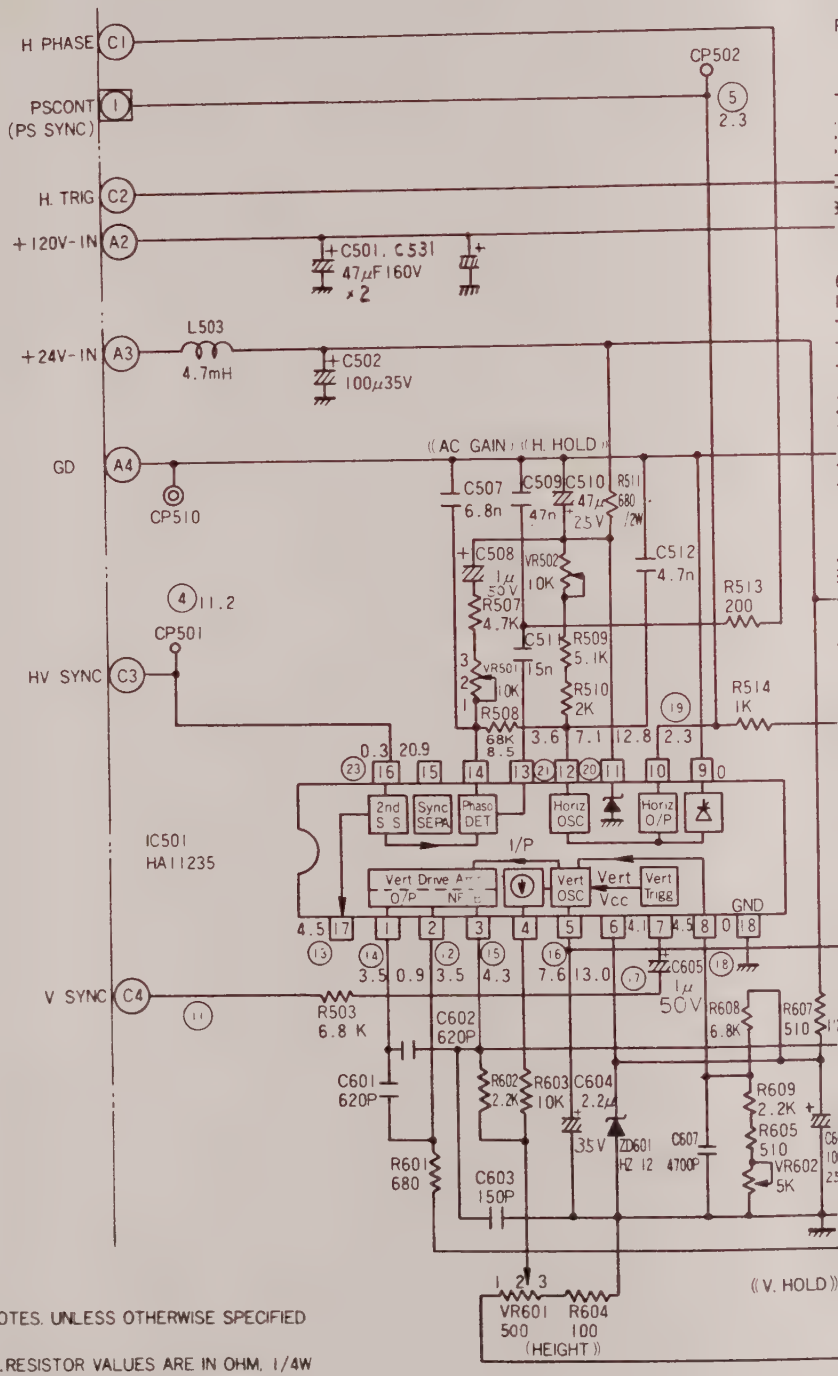
1 RESISTOR VALUES ARE IN OHM 1/4W

2 CAPACITOR VALUES ARE IN MICROFARAD



FVD 100 (A/3)

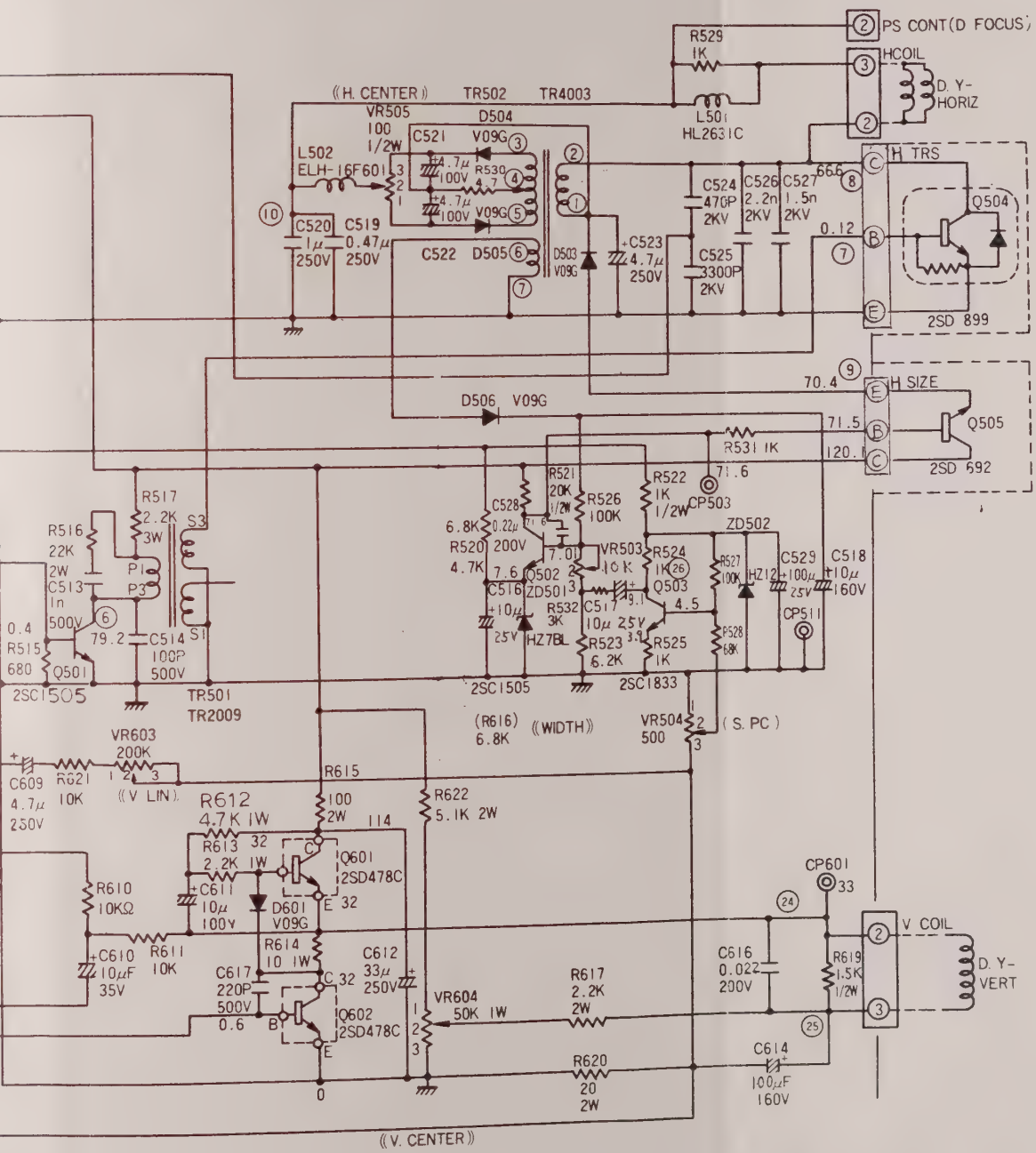
DWN.	K.SHIRAISHI	14.3.80	SCHEMATIC	REV'D
APPD.	K.KONAKA	14.3.80		
Hitachi, Ltd. Tokyo Japan			331SX69237	



NOTES. UNLESS OTHERWISE SPECIFIED

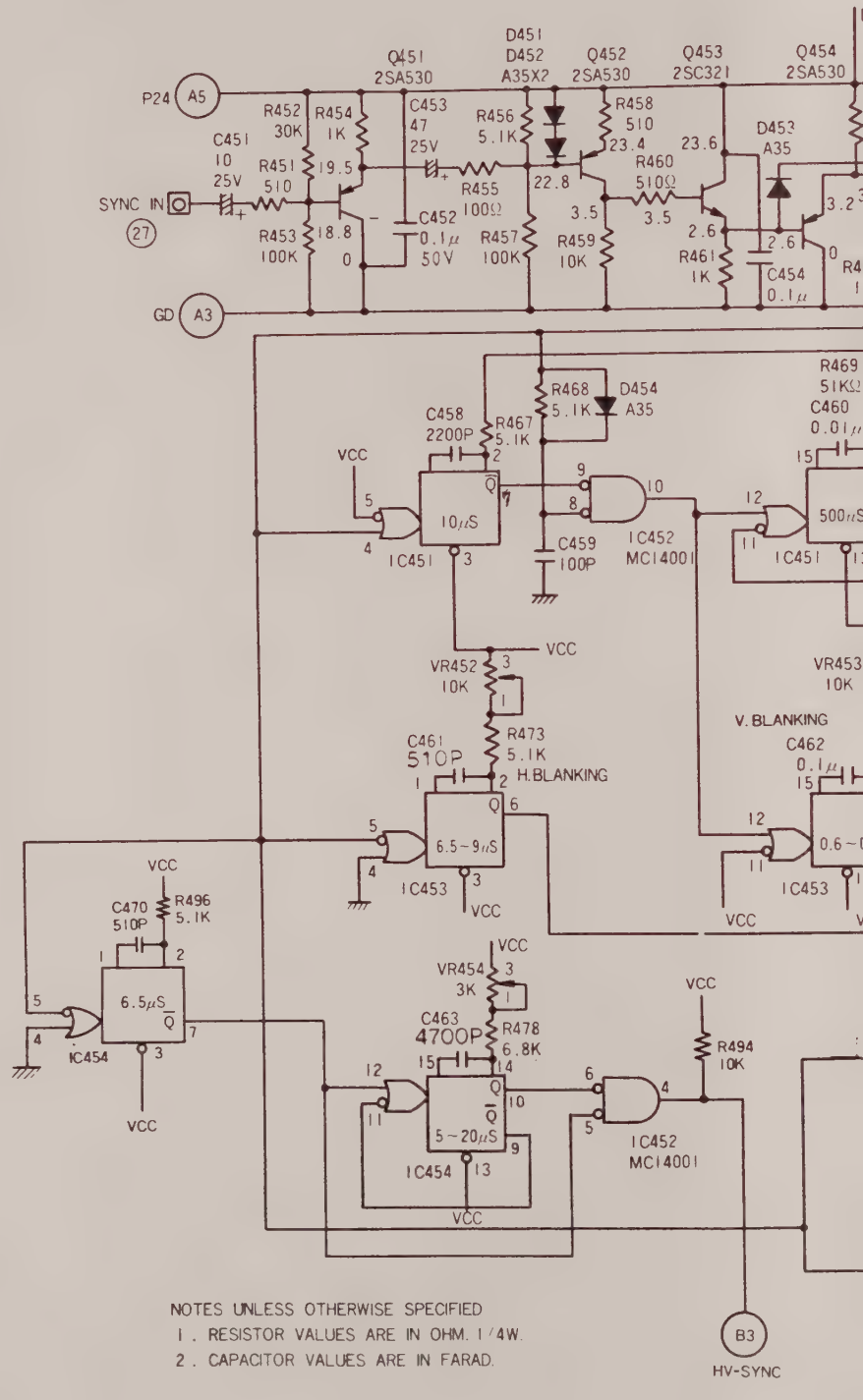
1. RESISTOR VALUES ARE IN OHM, 1/4W

2. CAPACITOR VALUES ARE IN FARADS,



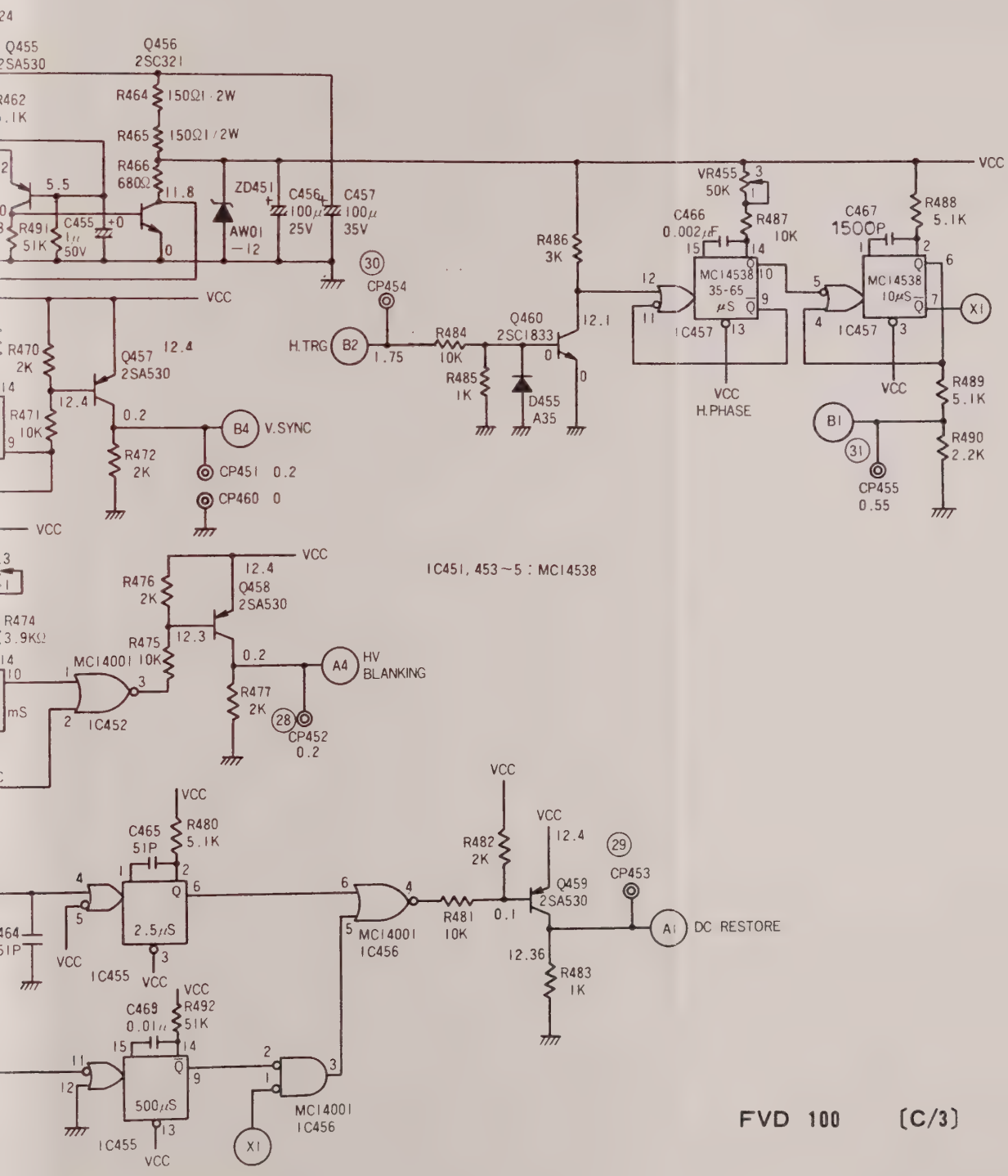
FVD 100 〔B/3〕

DWN.	K.SHIRAISHI	14.3.80	SCHEMATIC	REV'D
APPD.	K.KONAKA	14.3.80		
Hitachi, Ltd. Tokyo Japan			331SX69238	



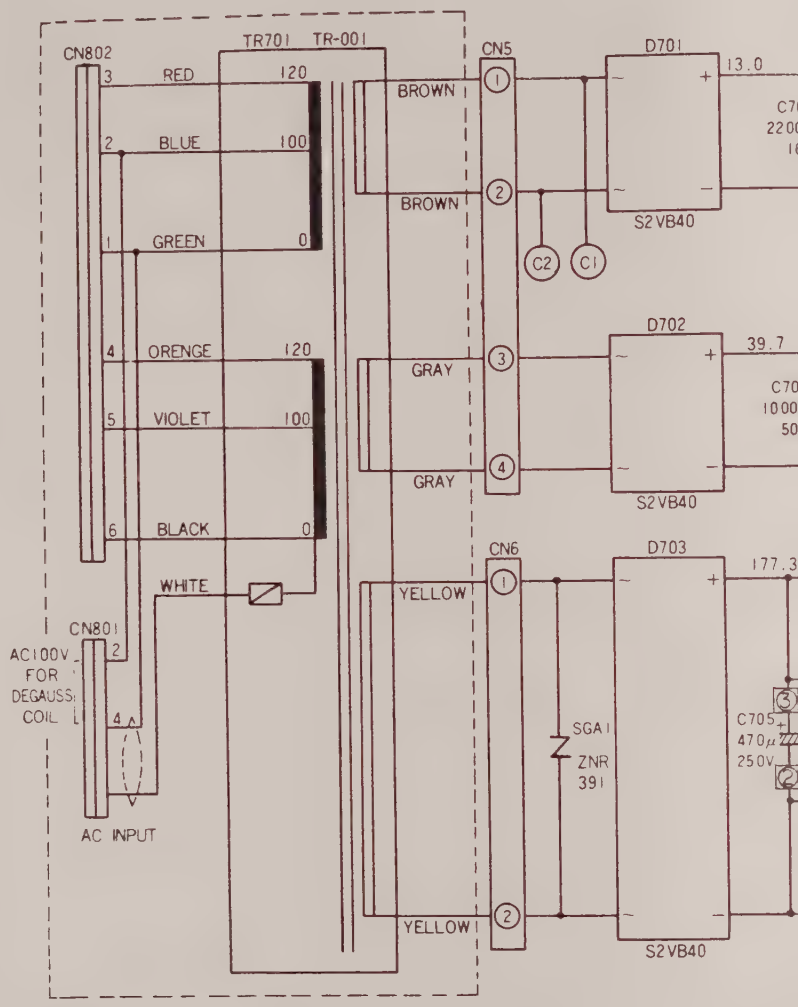
NOTES UNLESS OTHERWISE SPECIFIED

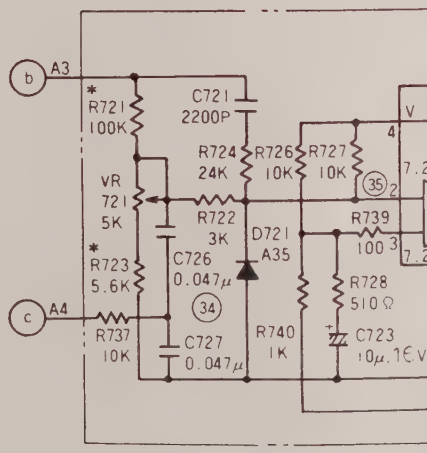
1. RESISTOR VALUES ARE IN OHM. 1/4W.
2. CAPACITOR VALUES ARE IN FARAD.



FVD 100 [C/3]

DWN.	K.SHIRAISHI	14.3.80	SCHEMATIC	REV'D
APPD.	K.KONAKA	14.3.80		
Hitachi, Ltd. Tokyo Japan			331SX69239	





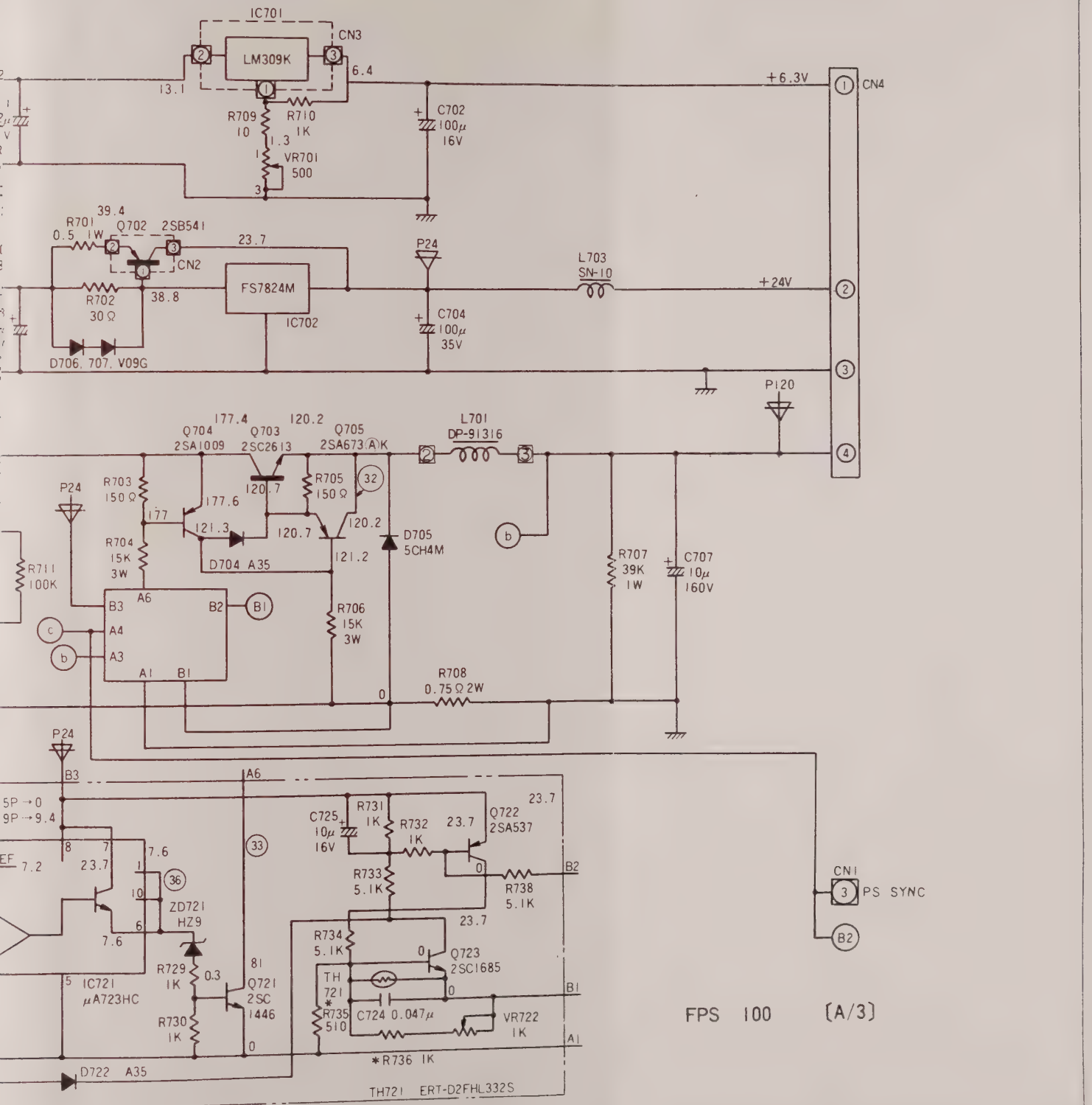
NOTES

UNLESS OTHERWISE SPESIFIED

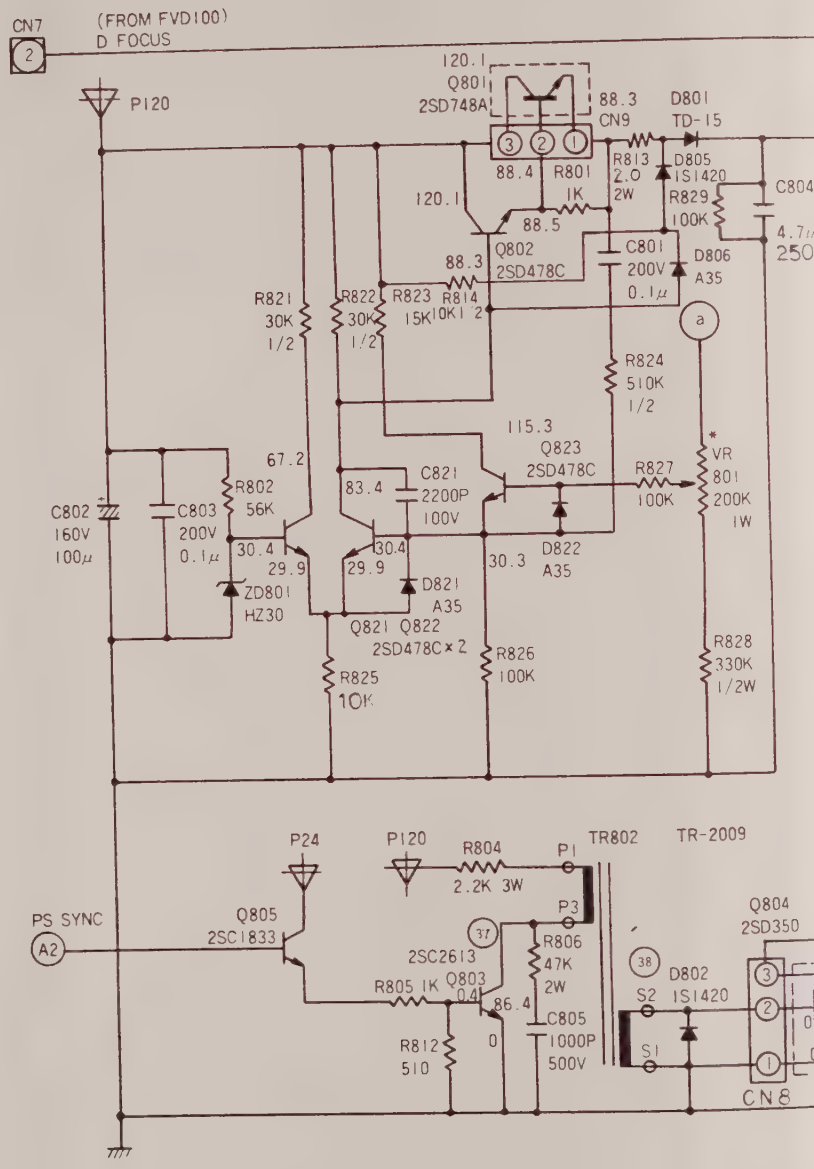
1. RESISTOR VALUES ARE IN OHM. 1 4 w

2. CAPACITOR VALUES ARE IN FARAD

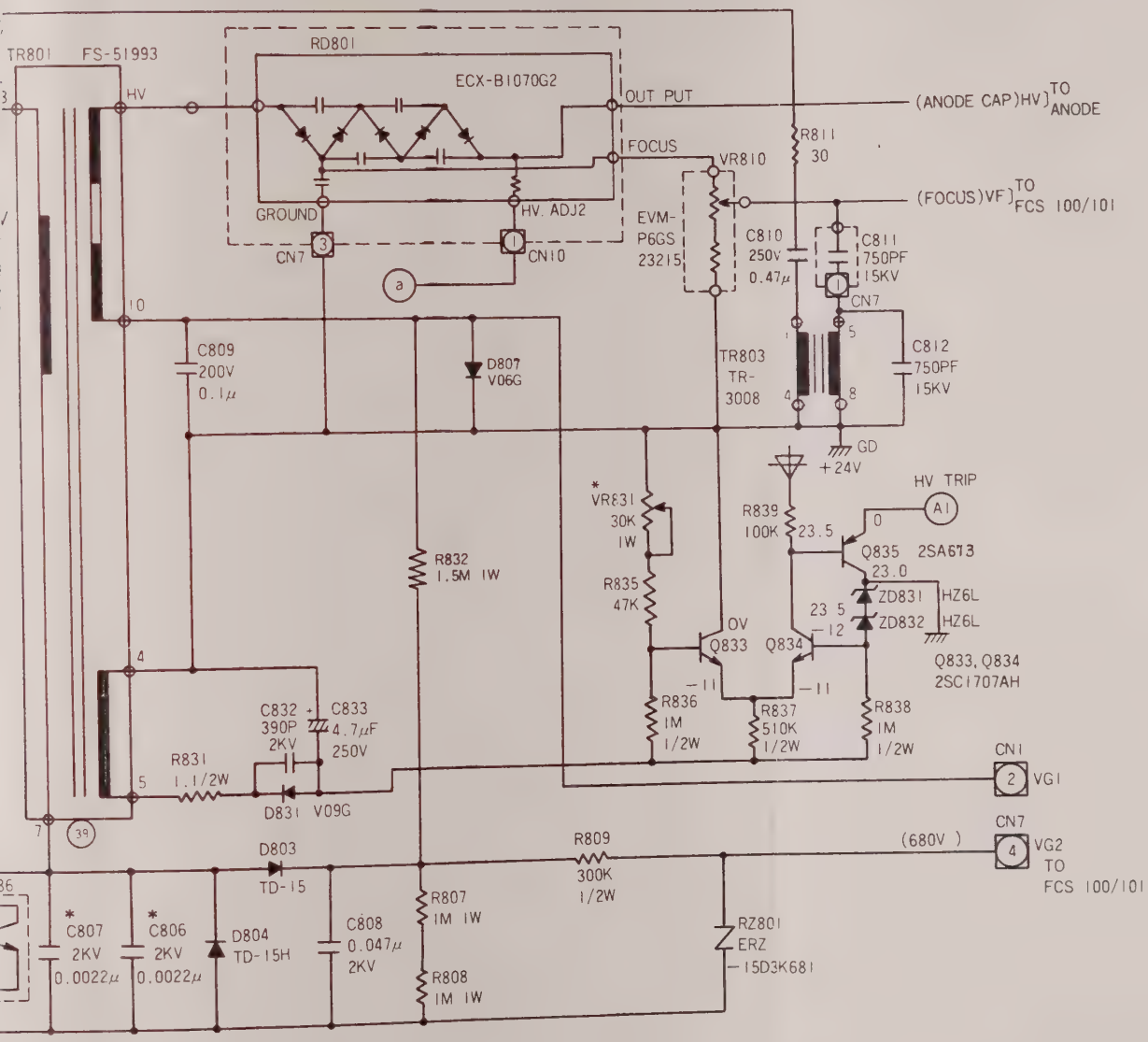
3. * All components shown are critical X-RAY safety related, replaces with exact part



DWN. K.SHIRAISHI 14.3.80		SCHEMATIC	REV'D
APPD. K.KONAKA 14.3.80			
Hitachi, Ltd. Tokyo Japan		331SX69240	

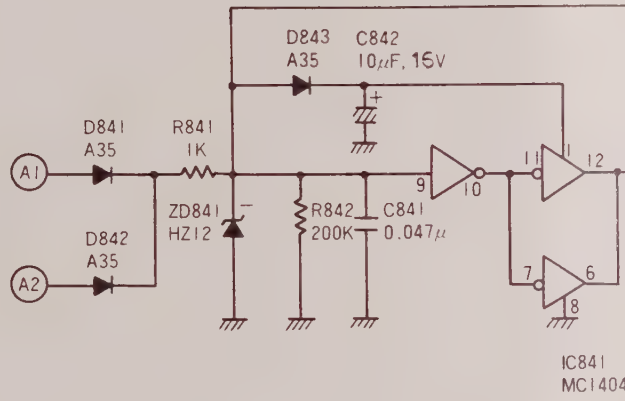


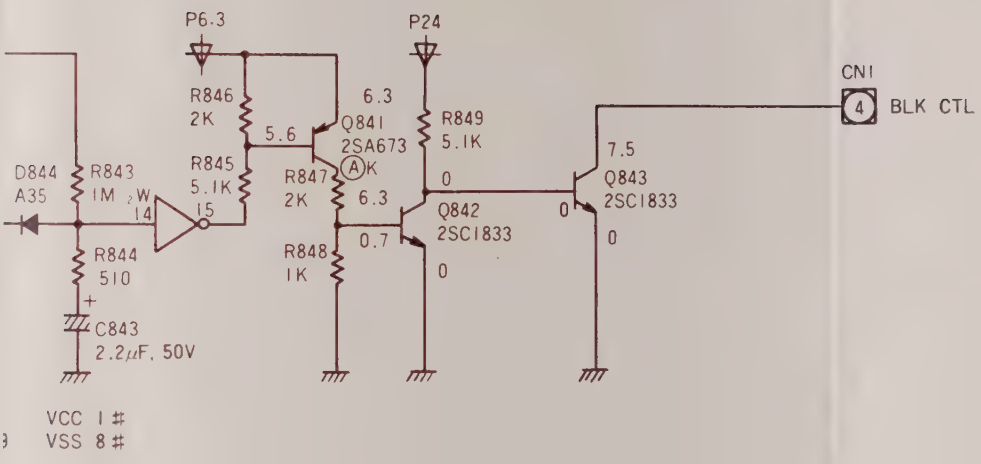
1. RESISTOR VALUES ARE IN OHM, 1/4W
2. CAPACITOR VALUES ARE IN FARADS
3. * All components shown are critical X-RAY safety related, replaces with exact part



FPS 100 (B/3)

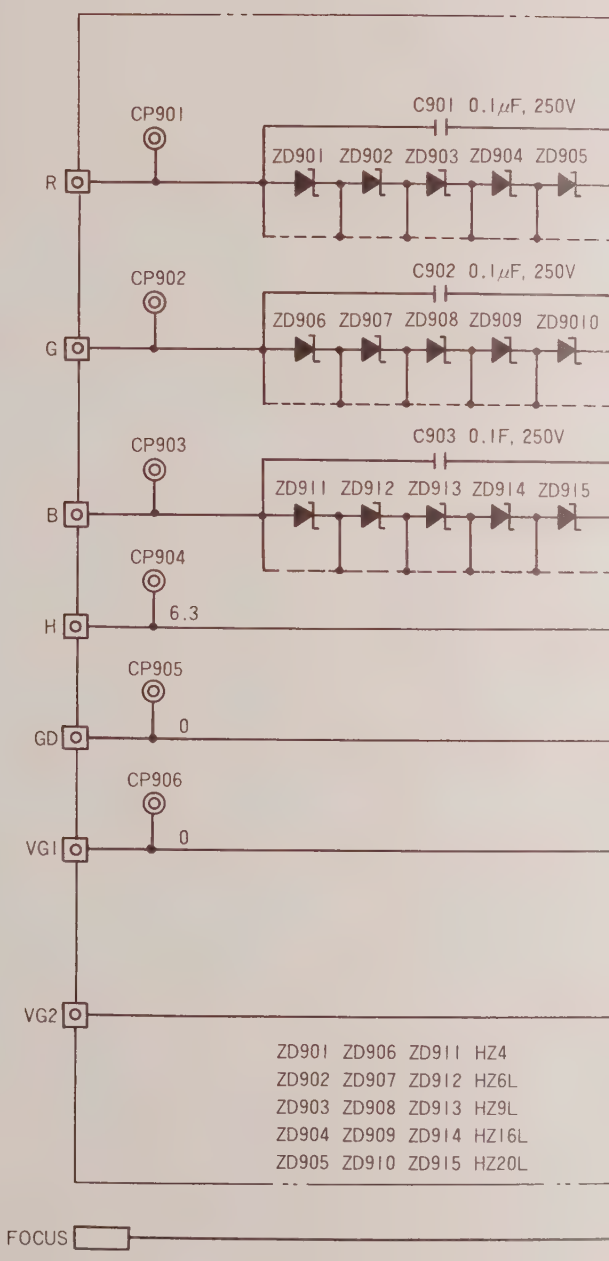
DWN.	K.SHIRAISHI	14.3.80	SCHEMATIC	REV'D
APPD.	K.KONAKA	14.3.80		
Hitachi, Ltd. Tokyo Japan			331SX69241	

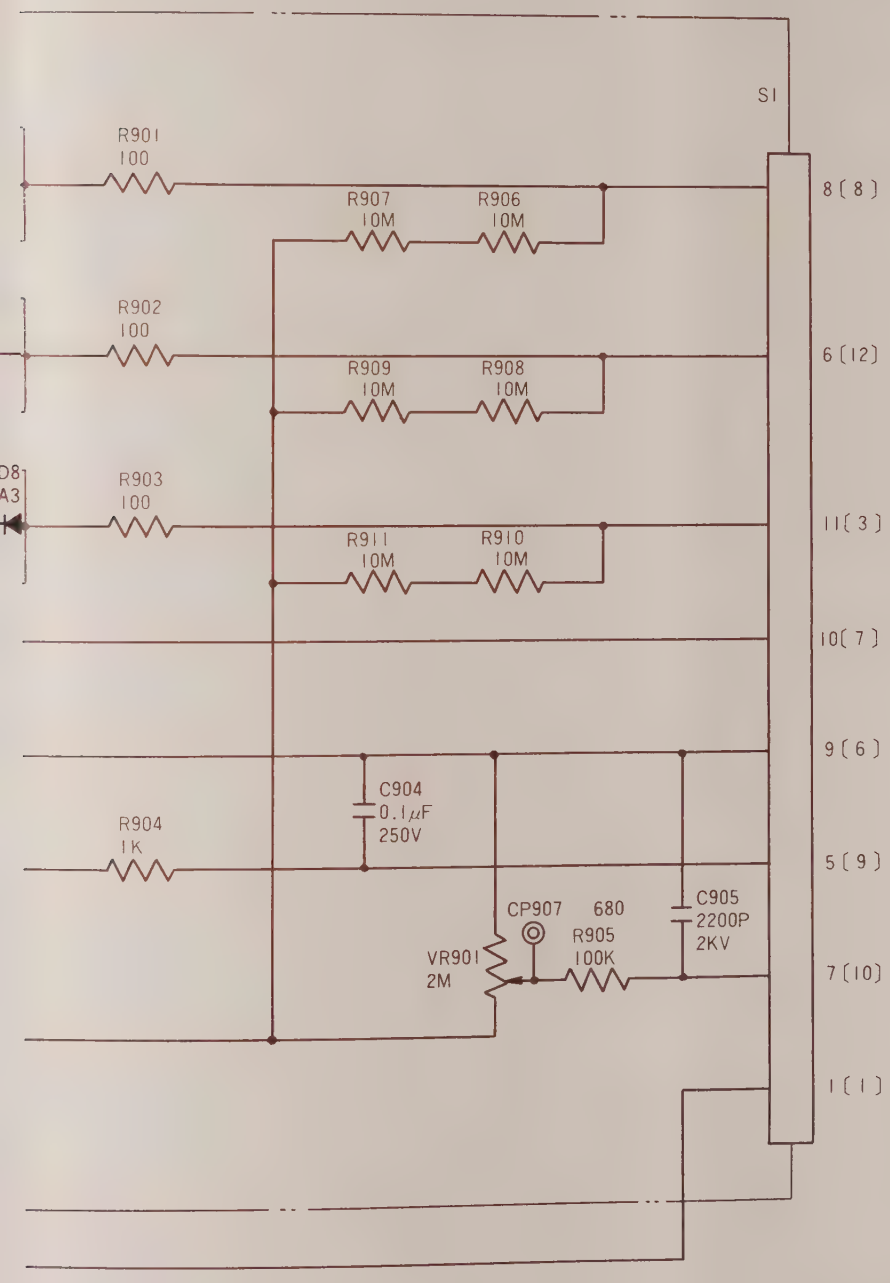

D843
A35
C842
10μF, 16V
D841
A35
R841
1K
A1
A2
D842
A35
ZD841
HZ12
R842
200K
C841
0.047μ
9
10
11
1
12
7
6
8
IC841
MC1404



FPS 100 (C/3)

DWN. K.SHIRAISHI 14.3.80			SCHEMATIC	REV'D
APPD. K.KONAKA 14.3.80				
Hitachi, Ltd. Tokyo Japan			331SX69242	


CP901
C901 0.1μF, 250V
ZD901 ZD902 ZD903 ZD904 ZD905
R
CP902
C902 0.1μF, 250V
ZD906 ZD907 ZD908 ZD909 ZD9010
G
CP903
C903 0.1F, 250V
ZD911 ZD912 ZD913 ZD914 ZD915
B
CP904
6.3
H
CP905
0
GD
CP906
0
VG1
VG2
ZD901 ZD906 ZD911 HZ4
ZD902 ZD907 ZD912 HZ6L
ZD903 ZD908 ZD913 HZ9L
ZD904 ZD909 ZD914 HZ16L
ZD905 ZD910 ZD915 HZ20L
FOCUS

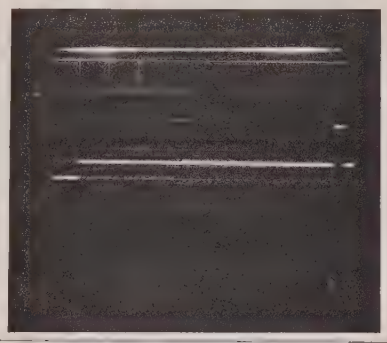
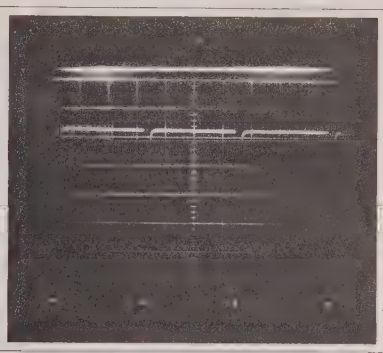
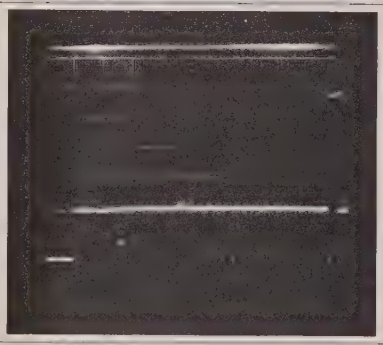
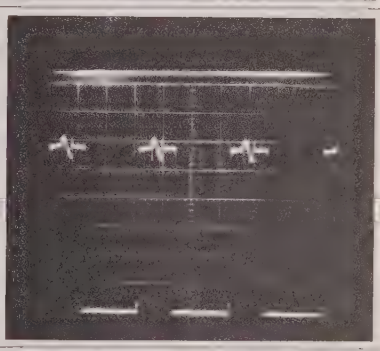
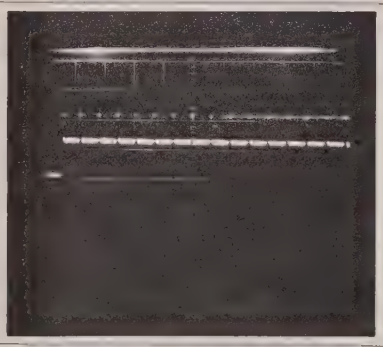
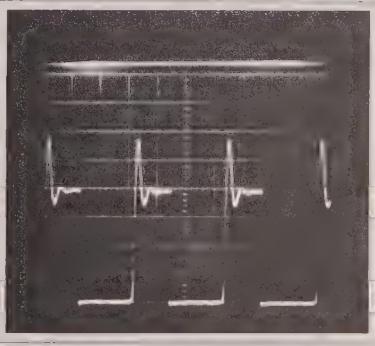
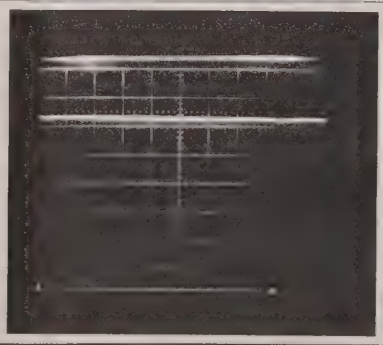
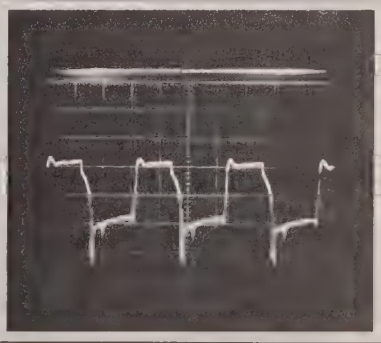


FCS 100 [FCS 101] [1/1]

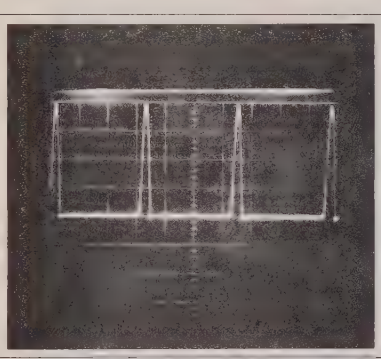
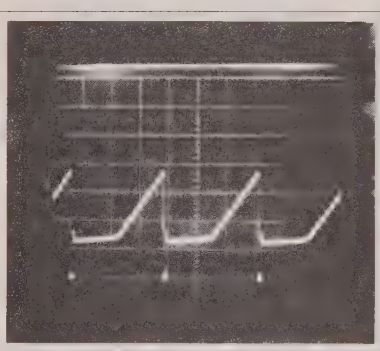
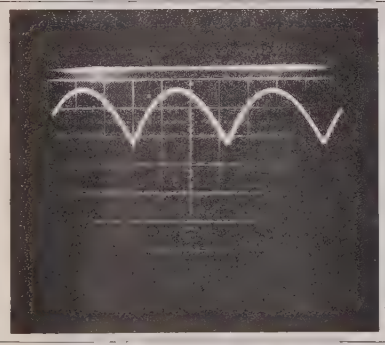
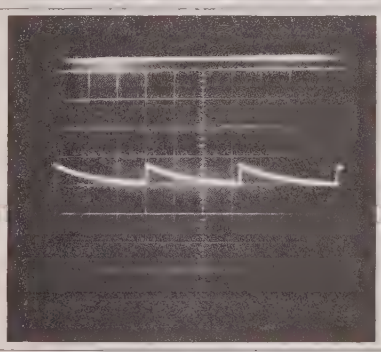
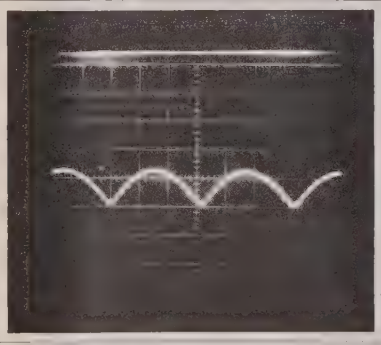
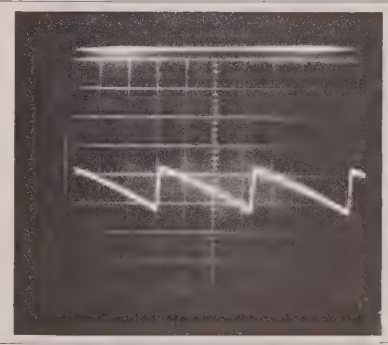
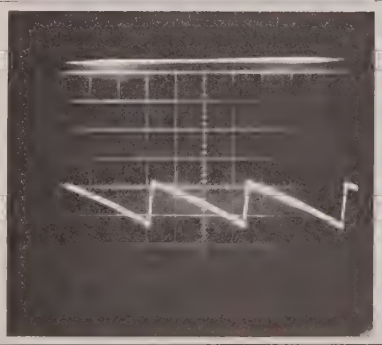
DWN.	K.SHIRAISHI	14.3.80	SCHEMATIC	REV'D
APPD.	K.KONAKA	14.3.80		
Hitachi, Ltd. Tokyo Japan			331SX69243	

APPENDIX VI
WAVE FORMS

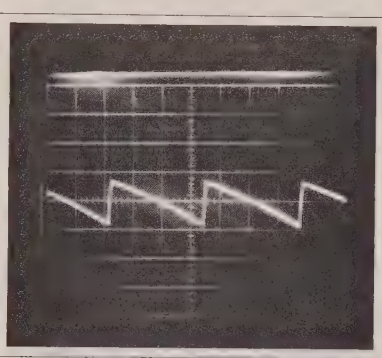
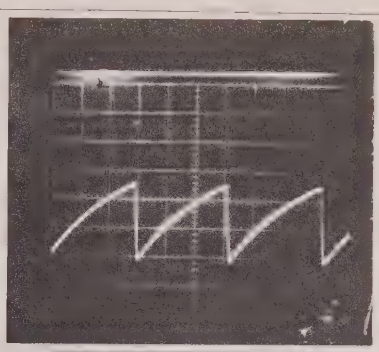
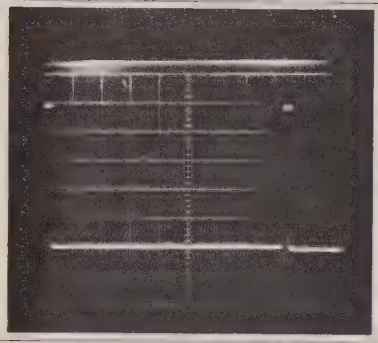
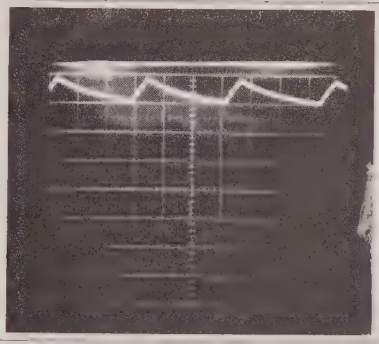
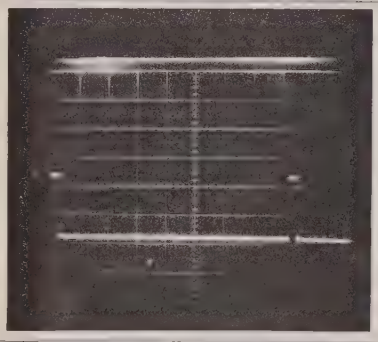
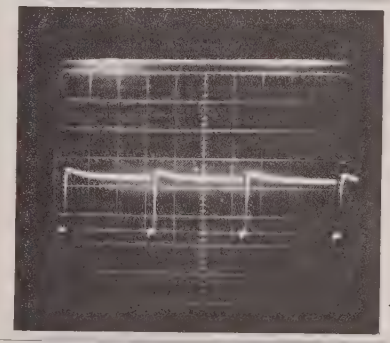
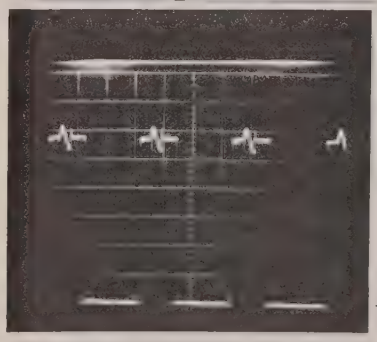
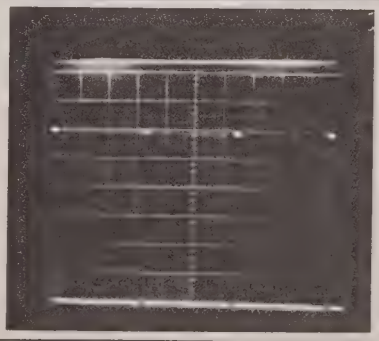
TYPE FVD100 (CONTROL DRAWER)
INPUT SIGNAL 1Vp-p composite H. . .15.75KHz V. . .60Hz
SCOPE INPUT 10Megohm shunted by 10pF

WAVEFORMS	comment	WAVEFORMS	comment
	① CP201 VIDEO INPUT ←0V AC 0.5V, 0.2msec		④′ CP501 HV SYNC (H-SIGNAL) DC 2V, 20μsec. ←0V
	② CP202 VIDEO INPUT + BRIGHT DC 0.5V, 0.2msec. ←0V		⑤ CP501 H. SIGNAL DC 1V, 20μsec. ←0V
	③ CP203 G-OUT DC 20V, 20μsec. ←0V		⑥ Q501-C H. SINGAL DC 50V, 20μsec. ←0V
	④ CP501 HV SYNC (V-SIGNAL) DC 2V, 2msec. ←0V		⑦ H TRS-B 0V DC ←1V, 20μsec.

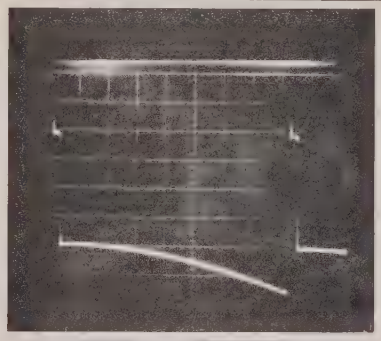
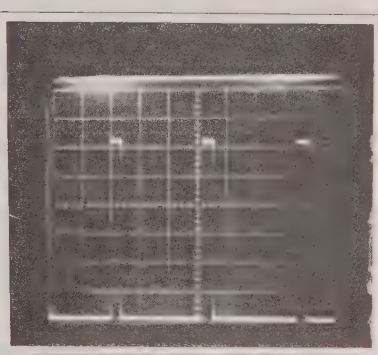
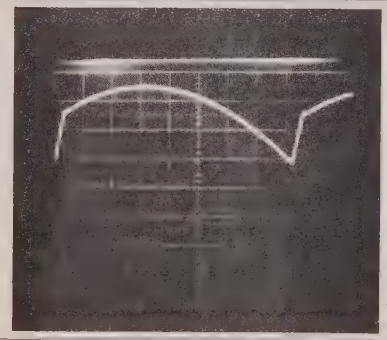
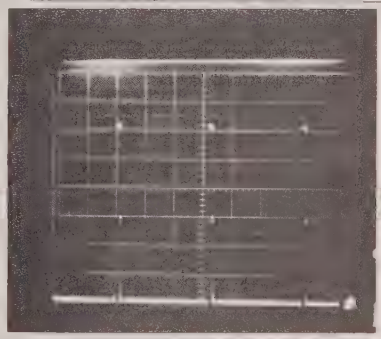
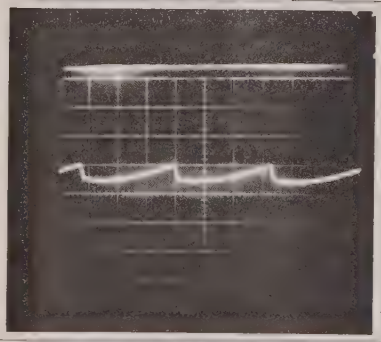
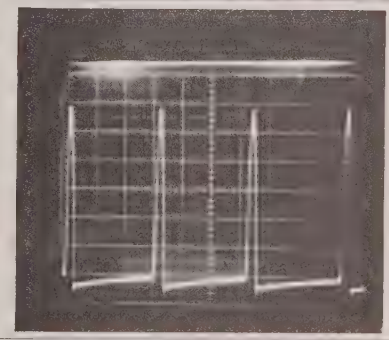
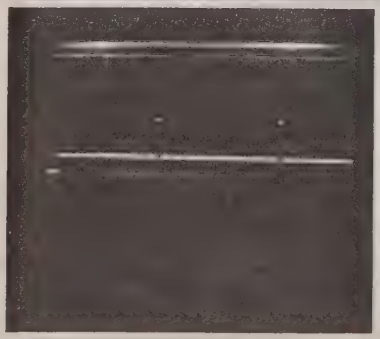
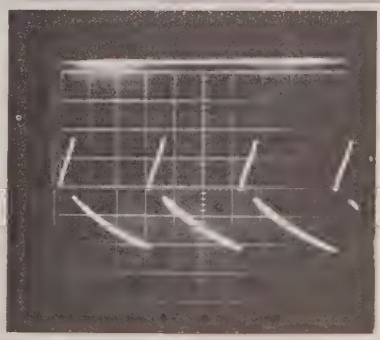
TYPE FVD100 (CONTROL DRAWER)
INPUT SIGNAL 1Vp-p composite H. . .15.75KHz V. . .60Hz
SCOPE INPUT 10Megohm shunted by 10pF

WAVEFORMS	comment	WAVEFORMS	comment
	⑧ H TRS-C ←0V DC 250V, 20μsec.		⑫ IC501 −2PIN V. SIGNAL DC 0.5V, 5msec. ←0V
	⑨ H SIZE-E (S-PC MAX) DC 10V, 5msec. ←0V		⑬ IC501 −17PIN H. SIGNAL DC 1V, 5msec. ←0V
	⑩ C520 H. SIGNAL DC 20V, 20μsec. ←0V		⑭ IC501 −1PIN V. SIGNAL DC 1V, 5msec. ←0V
	⑪ CP451 V. SYNC DC 2V, 2msec. ←0V		⑮ IC501 −3PIN V. SIGNAL DC 1V, 5msec. ←0V

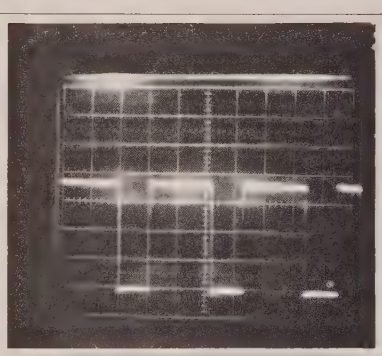
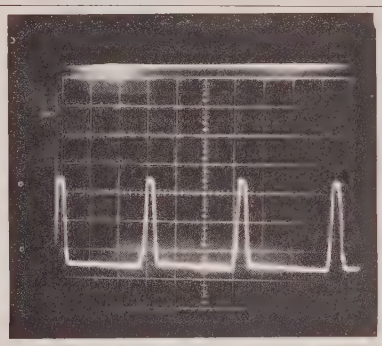
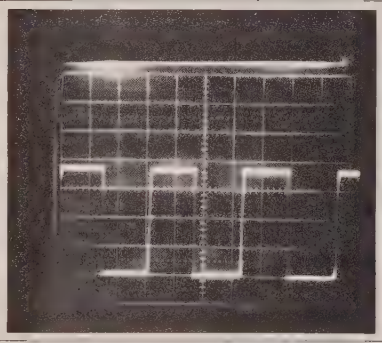
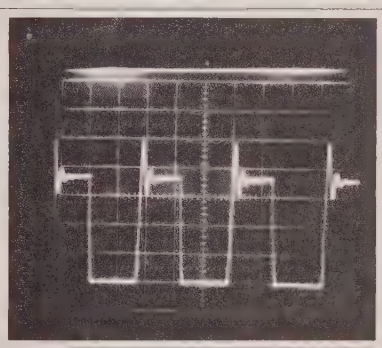
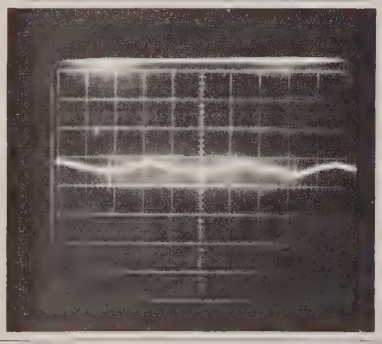
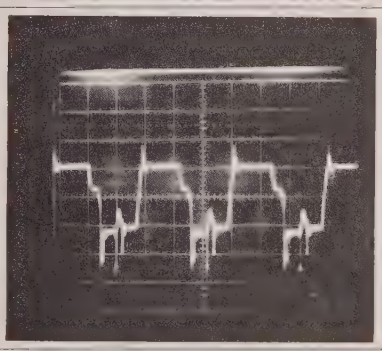
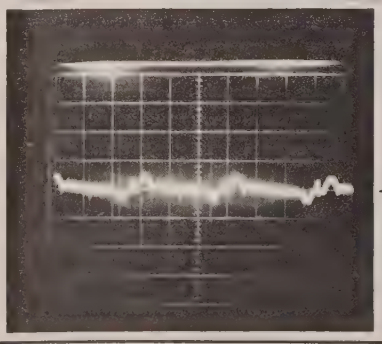
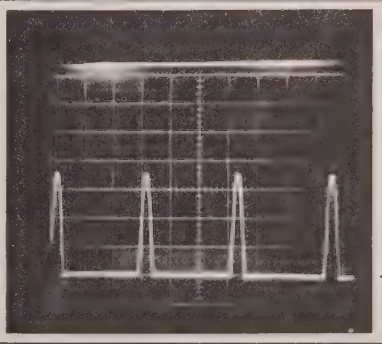
TYPE FVD100 (CONTROL DRAWER)
INPUT SIGNAL 1Vp-p composite H. . .15.75KHz V. . ..60Hz
SCOPE INPUT 10Megohm shunted by 10pF

	comment	WAVEFORMS	comment
	⑯ IC501 −5PIN V. SIGNAL DC 2V, 5msec. ←0V		⑳ IC501 −12PIN H. SIGNAL DC 2V, 20μsec. ←0V
	⑰ IC501 −7PIN V. SIGNAL DC 2V, 2msec. ←0V		㉑ IC501 −13PIN H. SIGNAL DC 0.5V, 20msec. ←0V
	⑱ IC501 −8PIN V. SIGNAL DC 2V, 2msec. ←0V		㉒ IC501 −15PIN H. SIGNAL DC 5V, 20msec ←0V
	⑲ IC501 −10PIN H. SIGNAL DC 1V, 20μsec. ←0V		㉓ IC501 −16PIN H. SIGNAL DC 2V, 20msec. ←0V

TYPE FVD100 (CONTROL DRAWER)
INPUT SIGNAL 1Vp-p composite H. . .15.75KHz V. . .60Hz
SCOPE INPUT 10Megohm shunted by 10pF

WAVEFORMS	comment	WAVEFORMS	comment
	㉔ CP601 V-COIL– 2 PIN DC 200V, 2msec. ←0V		㉘ CP452 HV BLANKING DC 2V, 20msec. ←0V
	㉕ V-COIL- 3 PIN DC 5V, 2msec. ←0V		㉙ CP453 DC RESTORE DC 2V, 20msec. ←0V
	㉖ Q503-C S-PC DC 2V, 5msec. ←0V		㉚ CP454 H. TRG DC 10V, 20msec. ←0V
	㉗ SYNC-IN ←0V DC 0.5V, 0.5msec.		㉛ CP455 H. PHASE DC 0.2V, 20msec. ←0V

TYPE FPS100 (POWER SUPPLU)
INPUT SIGNAL 1Vp-p composite H...15.75KHz V...60Hz
SCOPE INPUT 10Megohm shunted by 10pF

WAVEFORMS	comment	WAVEFORMS	comment
	㉜ Q705-C P120 DC 50V, 20μsec. ←0V		㊱ IC721 –6PIN DC 5V, 20μsec. ←0V
	㉝ Q721-C P120 DC 50V, 20msec. ←0V		㊲ Q803-C HIGH VOLTAGE DC 50V, 20μsec. ←0V
	㉞ R737 P120 SWITCHING SIGNAL DC 0.5V, 20msec. ←0V		㊳ Q804-B ←0V DC 1V, 20μsec.
	㉟ IC721 –2PIN ←0V AC 0.05V, 20μsec.		㊴ Q804-C (TR801-7) HIGH VOLTAGE DC 250V, 20μsec. ←0V

APPENDIX VII

PARTS ARRANGEMENT

FVD 100	331SX69245
FPS 100	331SX69246
FCS 100 [FCS101]	331SX69247

H-COIL
PS-CONT
DC-PS
L501
C520
C526
C527
R529
CP510
C514
P3P
C519
R616
C513
R516
D502
L502
Q501
R515
C524
H-TRS
C525
R519
C515
R518
D504
R530
D505
C521
C522
C528
VR505
R526
TR502
CP502
C523
D506
D503
H-SI7F
C608
R608
C502
VR602
VR503
R609
R605
C604
C529
C605
C606
VR601
C607
C603
CP501
C503
R607
R503
ZD601
C602
R602
R604
C601
R601
C603
R502
C504
R504
C505
R506
C506
C507
C509
VR501
R505
C512
R510
R509
C508
C511
IC501
VR502
R513
R511
R514
C510
IC453
IC454
IC456
VR455
VR451
VR453
VR452
VR454
R474
C462
R473
C461
R478
C463
R476
R475
Q458
R477
CP452
IC452
C458
R467
C459
R468
D454
IC451
CP451
C460
R469
Q457
R470
R471
R472
CP460
IC457
J1
C530
R484
D455
CP454
C468
R486
Q460
R485
C467
R488
C466
R487
R490
R489
CP455
R482
Q459
R492
R480
R479
R464
R465
ZD451
R466
R462
D453
Q453
R481
R483
C469
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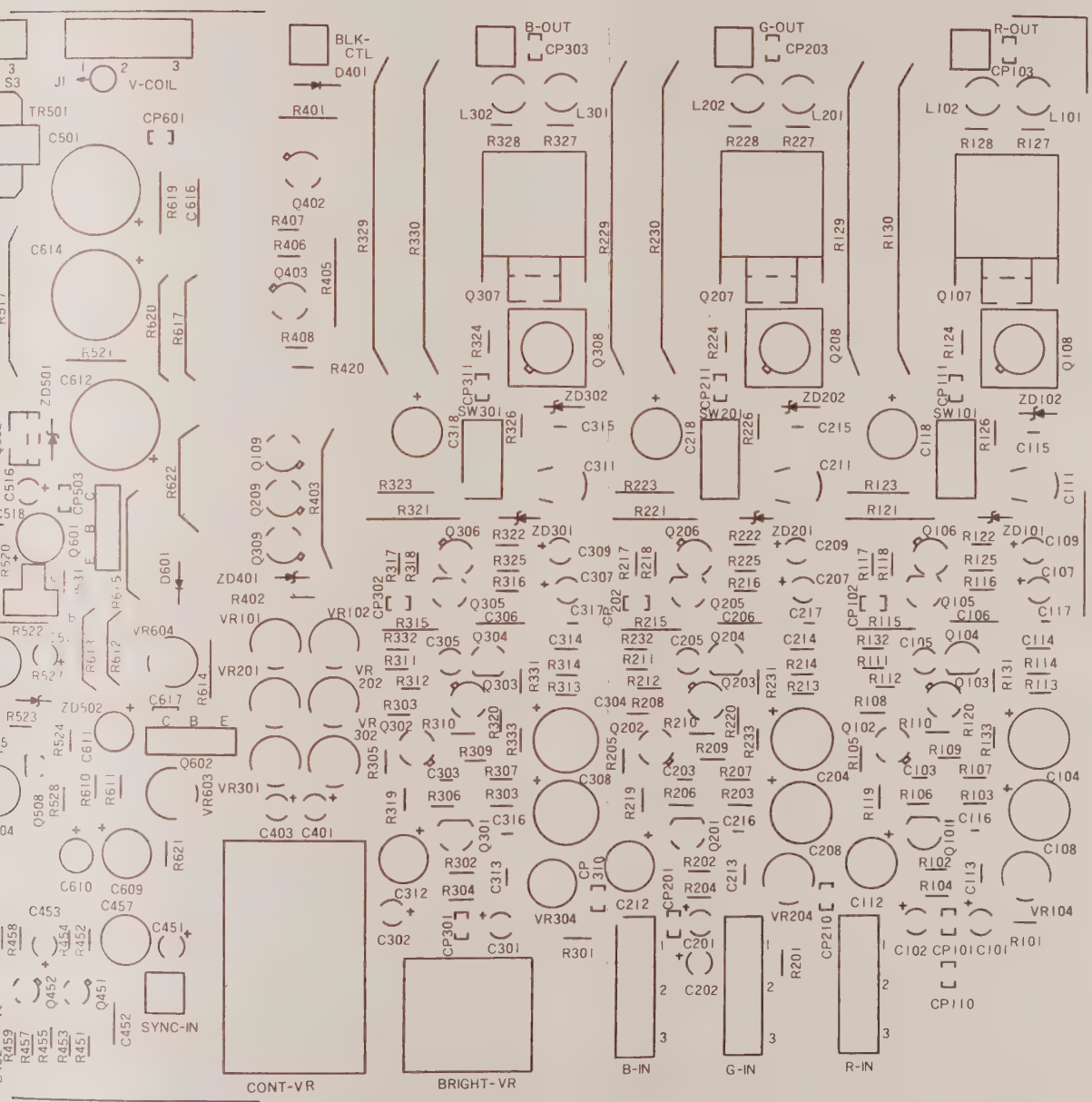
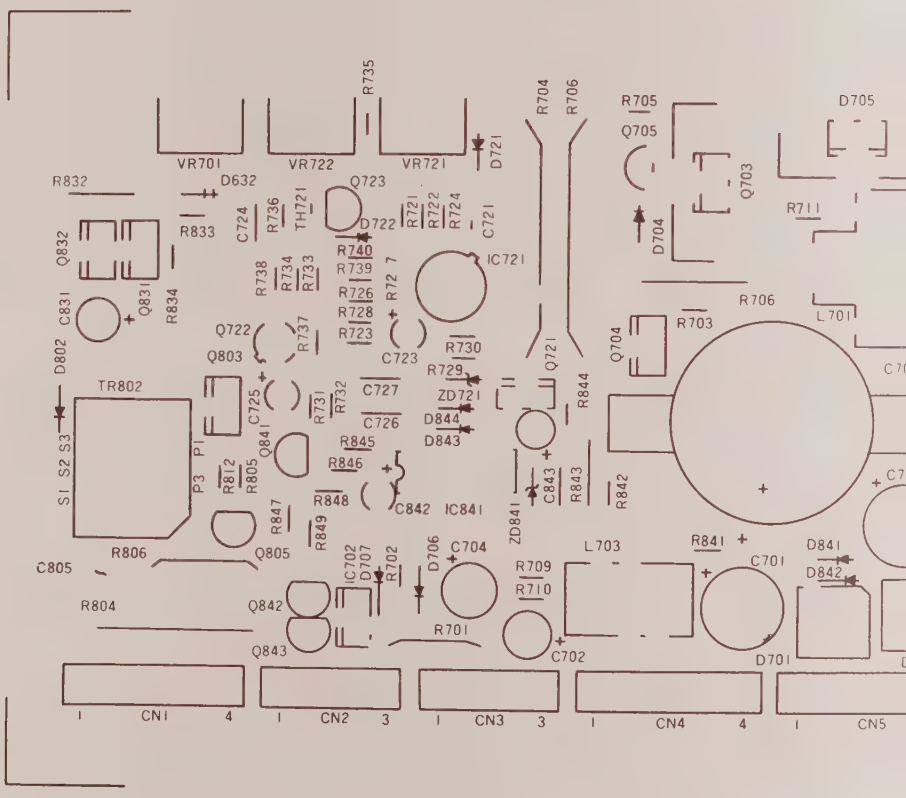
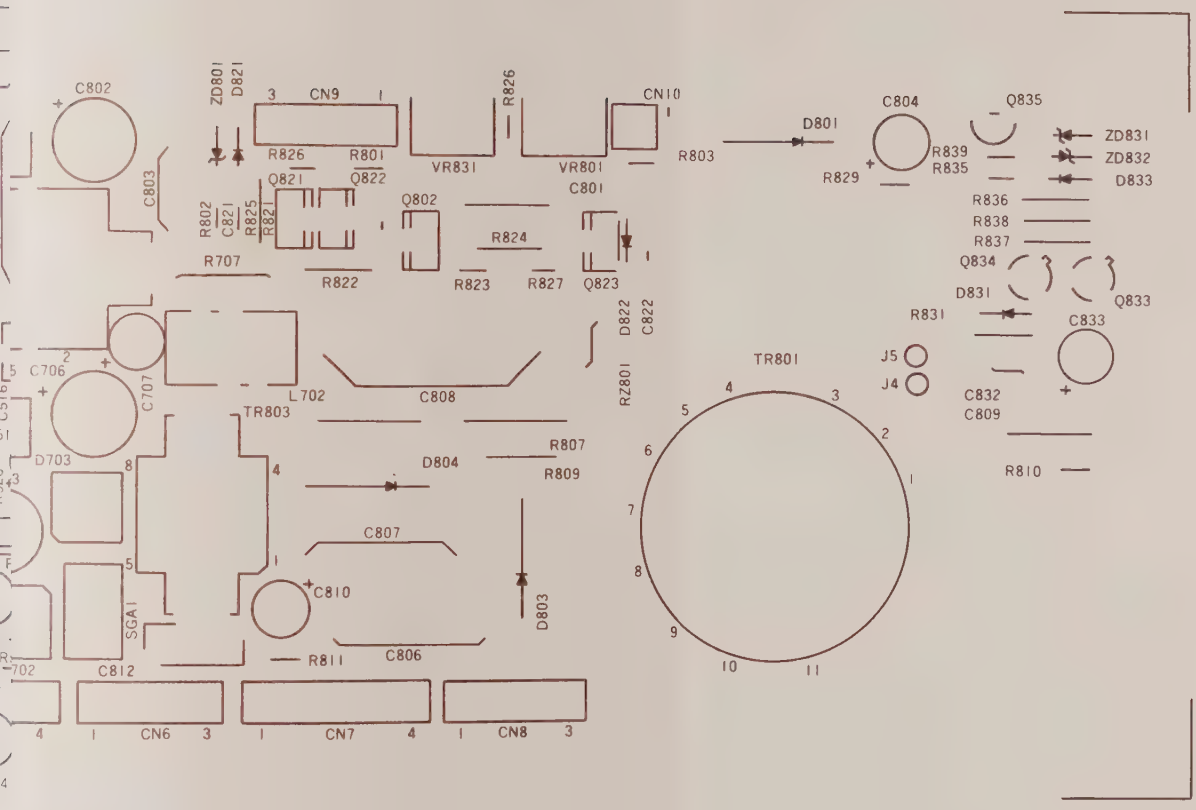
R461
C454
R460
D451



FVD 100

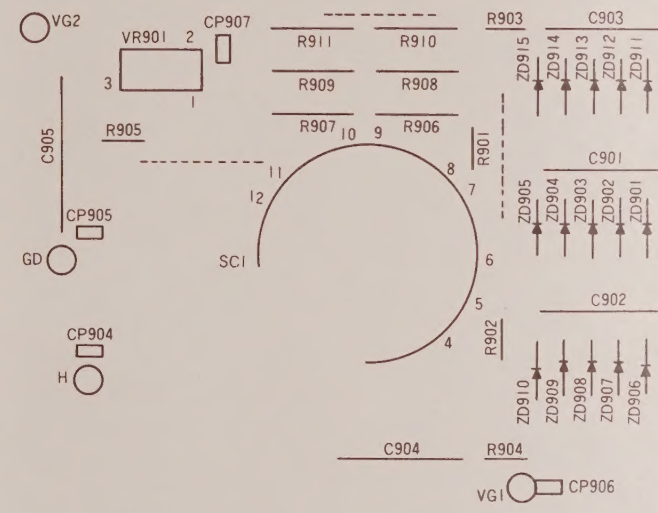
DWN.	K.SHIRAISHI	14.3.80	PARTS LAYOUT	REV'D
APPD.	K.KONAKA	14.3.80		
Hitachi, Ltd. Tokyo Japan			331SX69245	


R735
VR701
VR722
VR721
D721
R704
R706
R705
Q705
D705
R832
D632
Q723
Q703
R711
Q832
R833
C724
R736
TH721
R721
R722
R724
C721
D722
D704
R740
R739
IC721
R738
R734
R733
R726
R728
R723
R727
R706
R703
L701
Q831
R834
C831
Q722
Q803
R737
C723
R730
R729
Q704
D802
TR802
C725
C727
ZD721
Q721
R844
R731
R732
D844
C726
D843
R845
Q841
S1 S2 S3
P3
P1
R812
R805
R846
C843
R843
R842
R848
C842
IC841
ZD841
R847
R849
R841
D841
C805
R806
Q805
IC702
D707
R702
D706
C704
L703
C701
D842
R804
Q842
R709
R710
R701
C702
Q843
D701
CN1
CN2
CN3
CN4
CN5

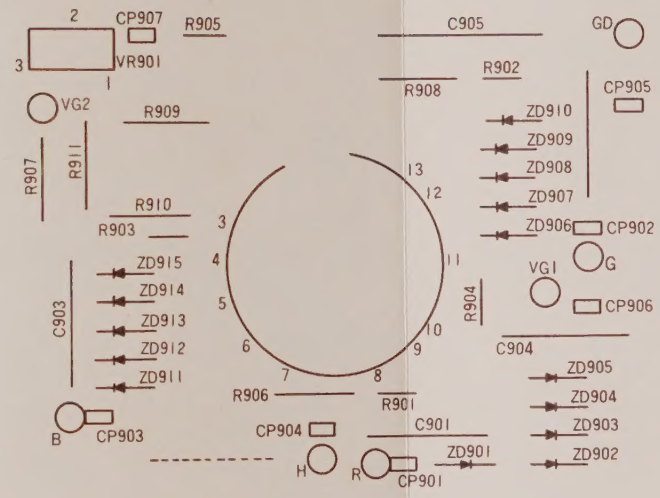


FPS 100

DWN.	K.SHIRAISHI	14.3.80	PARTS LAYOUT	REV'D
APPD.	K.KONAKA	14.3.80		
Hitachi, Ltd. Tokyo Japan			331SX69246	


VG2
VR901
2
3
1
CP907
R911
R910
R909
R908
R907
10
9
R906
R903
C903
ZD915
ZD914
ZD913
ZD912
ZD911
R905
C905
R901
C901
11
12
8
7
CP905
GD
SCI
6
5
ZD905
ZD904
ZD903
ZD902
ZD901
C902
CP904
H
4
R902
ZD910
ZD909
ZD908
ZD907
ZD906
C904
R904
VG1
CP906

FCS 100



FCS 101

DWN.	K.SHIRAISHI	14.3.80	PARTS LAYOUT	REV'D
APPD.	K.KONAKA	14.3.80		
Hitachi, Ltd. Tokyo Japan			331SX69247	

OM-1149E